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AMERICAN MACHINIST

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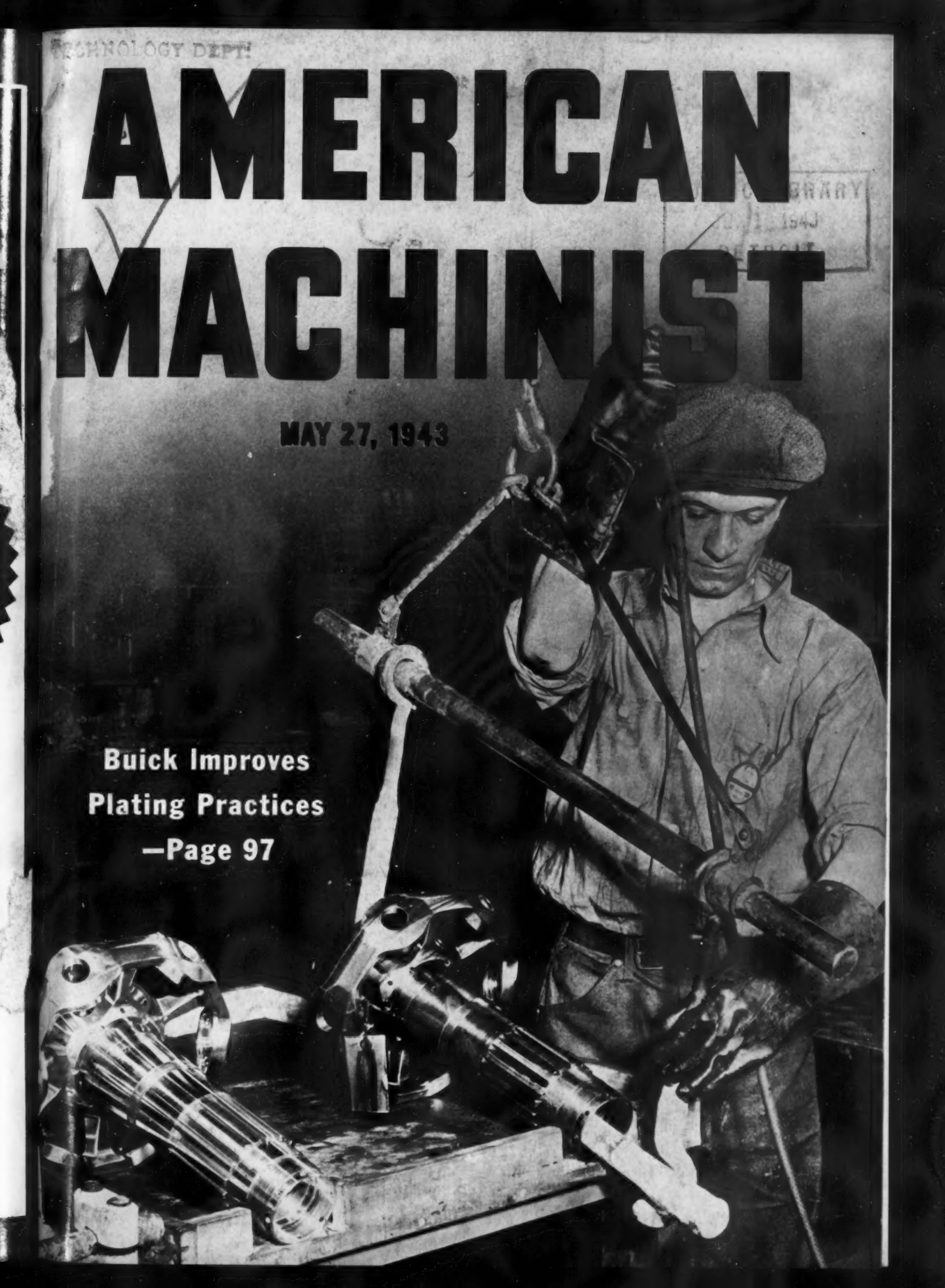
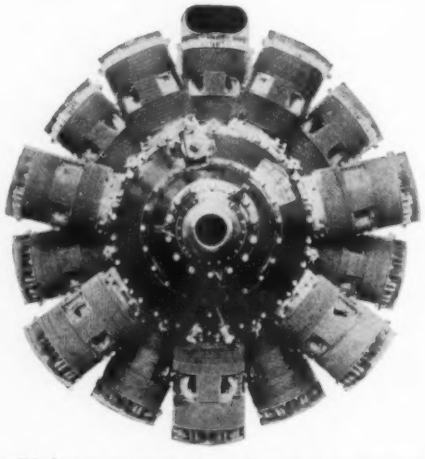


Buick Improves Plating Practices
—Page 97

HOW HEALD ENGINEERING
SOLVED A WARTIME PROBLEM

BOMBS
AND BRISTOL SLEEVES
OVER BERLIN



Simplified exterior construction and compactness are among the features of this Bristol Hercules single sleeve engine

Not only bombs were carried by those avenging Short-Sterlings giant bombers which left Berlin a hell of seething flame that gentle spring night in '43 . . . they carried; too, the sweat and skill of many men which made such flights possible. Take, for instance, the case of the Bristol Sleeve, and how a wartime problem was solved.

This sleeve is the heart of the Bristol Sleeve-Valve Engine—the engine whose outstanding performance has contributed so largely to the success of long range bombing raids by the R.A.F. Apparently only a simple cylinder of steel, actually its length and diameter and wafer thin wall make it so elastic, so unstable, that grinding it with the machine tools available during the development period could only be done in limited quantities and under laboratory conditions. But Bristol wanted laboratory precision plus mass production. How?

Calling in Heald Service Engineers produced the solution—a special Heald Internal Grinding Machine designed to grind the sleeve by the Centerless principle of supporting it and rotating it on the O. D. between three rolls—a solution so satisfactory that it has become a major factor in the mass production of Bristol Engines.

Have you a wartime problem or do you need assistance in post-war planning? If it involves precision finishing, HEALD ENGINEERING is available, now, to help you.

The HEALD Machine Co., Worcester, Mass.

For More Precision Faster, bring your problems to Heald

AMERICAN MACHINIST

May 27, 1943

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AMERICAN MACHINIST *Chips*

It is a privilege for *American Machinist* to reproduce this poem. Simply, calmly but with inescapable reality it demands an accounting of every American's conscience.

The author, R. L. Nicholson, is a war worker at the Wolf Creek Ordnance Plant, Milan, Tenn. His poem appeared first in the plant's employee bulletin, then in *This Week Magazine*. Through the liberal permission of Mr. Nicholson and *This Week*, we bring you this message of particular significance to Metal-Working, America's Armament Industry.

★

QUESTION FOR AMERICANS

A war worker asks it. What can you answer?

by R. L. Nicholson

What did you do for Freedom today?
A Marine on Guadalcanal,
Through a hail of lead and jungle hell,
Crept out to a wounded pal;
And he dragged him back through the slime and muck,
Then, with never a thought of rest,
Back over that deadly route he went
And smashed a machine-gun nest.
It wasn't much fun—the bullets—the mud—
He may have been scared, but he hid it;
He only knew of a job to do
And he didn't quibble, he did it.
What did you do for Freedom today?
"All that you could." Think well—
One-millionth as much as that Leatherneck did?
—They buried the boy where he fell.

What did you do for Freedom today?
A Gob on a rubber raft
Drained the last wet drop from his water flask
Then threw it away and laughed.
For eighteen days on an endless sea
In a torment of pain he lay;
Drenched and chilled to the bone at night,
And burned to a crisp by day.
He wanted to live, but he knew in his heart
That the odds were a thousand to one;
But he drifted and hoped, consoled by a prayer,
And the thought of a job well done.
What did you do for Freedom today?
"All that you could," you declare.
But when you say it, remember the Gob
Who died on the raft out there.

What did you do for Freedom today?
Nine lads in a B-17
Ran into a flock of Messerschmitts
And died in their wrecked machine.
Oh, they didn't do bad with what they had,
But they flew through hell to do it;
They had smashed Berlin and a dozen "one-ten's"
But their number was up and they knew it.
They were full of holes, with no controls,
And their ship was a comet of flame;
But they stuck to their guns and the useless stick
And battled on just the same.
What did you do for Freedom today?
"All that you could." O.K.;
But if those nine boys in the B-17
Were to ask you, what would you say?

What did you do for Freedom today?
I think they've a right to ask.
You're in this fight just as much as they,
And with just as important a task.
Were you at your desk, or bench, or press,
And at work at the starting bell?
Did every minute of this day count?
And the job—did you do it well?
Did you buy a Bond or a Stamp today?
Or collect any scrap for the pile?
Did you save your grease or throw it away?
Did you drive just an extra mile?
Have you been down to the Red Cross Bank
And given a pint of your blood?
Did you send that V-mail letter today?
Did you hoard any rationed food?
Before you begin to complain and gripe
That life is all work and no fun—
Would you trade your dinner for Ration K?
Or your overtime pay for a gun?
Just stop every once in a while today
When your lot seems hard and lean,
And think of a Gob, and a Leatherneck,
And nine boys in a B-17.

★

REPRINTS AVAILABLE AT NO CHARGE IN QUANTITIES UP TO 25.

AVOID DISTORTION WHEN YOU QUENCH

MANY precision parts must be quenched to obtain necessary strength and hardness. An uncontrolled quench, however, results in distortion, which either destroys previously machined accuracy, or necessitates leaving excessive stock to be removed after hardening.

Gleason quenching presses eliminate both of these undesirable conditions by providing a *controlled* quench which holds distortion to a minimum. The principle is simple—the work is held between dies and aligned while still plastic. It is then submerged, and the dies allow normal contraction, while directing the flow of quenching oil so that an absolutely uniform quench is obtained. The rate of quench may be regulated as desired, down to a few seconds per part. An automatic timer returns the work to loading position, assuring uniform length of quench for all parts.—All the operator does is to load the press and push the button.

Manufacturers are finding Gleason presses ideal for a variety of work—gears, discs, lines, bearing cups and cones, —even such parts as crankshafts and breech blocks.

The presses are made in two sizes, 15″ and 25″, for parts up to these respective diameters. The 25″ press can be supplied with a roller fixture attachment for quenching shafts and integral shaft pinions up to 22″ length.

Let us show you how a Gleason quenching press can solve your quenching distortion problems. Write for information or, better yet, send prints of the parts you want to quench.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

ARMY E NAVY

INEXPERIENCE IS NO HANDICAP WHEN YOU USE CINCINNATI 0-8s

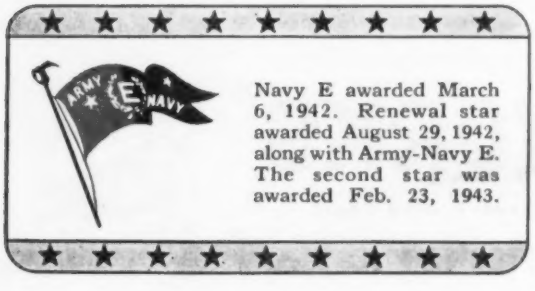
The longer the war lasts, the more necessary it becomes to recruit "green" help for industry. Such a situation makes the need for safe, automatic machinery of paramount importance.

In the CINCINNATI 0-8 Plain Automatic Milling Machine with automatic Rise and Fall Spindle Carrier, the engineers here at Milling Headquarters have partially solved the experienced help shortage by making the machine completely automatic. Load the fixture, flip the starting lever, and the machine goes through the entire cutting cycle automatically. You don't need skilled operators. Almost anyone can handle the CINCINNATI 0-8 Plain Automatic Miller — a tremendous advantage in times like these. Set-up is comparatively simple because changing from one automatic cutting cycle to another is easily and quickly accomplished.

If you mill small parts, you'll find the 0-8 has many distinct advantages. It is especially desirable on jobs where the work cannot traverse directly into the cut because the Rise and Fall Spindle Carrier makes it possible to take obstruction jumps automatically.

For a brief description of the CINCINNATI 0-8, look in Sweet's Catalog File for Mechanical Industries. Or write for specification catalog M-964-1 which gives complete details.

CINCINNATI



Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

THE CINCINNATI MI

MILLING MACHINES

Milling a keyway in a short shaft on a CINCINNATI 0-8 Plain Automatic Miller with automatic Rise and Fall Spindle Carrier. Sequence of operations is shown by the cycle diagram. (Cycle No. 4Y.)

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

INACCURACIES

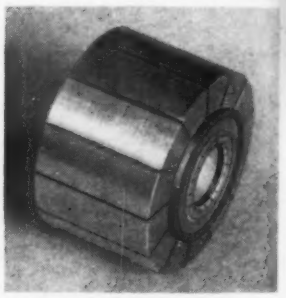
in Vital Airplane Parts are ELIMINATED

by inspection with Jones & Lamson Optical Comparators

These small commutators for aircraft radio sets were examined with a magnifying glass until the Westinghouse Electric & Manufacturing Company installed **Jones & Lamson Optical Comparators** for the inspection of these parts.

Now they are inspected rapidly, positively and with less fatigue. Moreover, production was increased by 20 per cent.

Many other farsighted manufacturers have discovered the practical advantages of inspection by optical projection, after consulting Jones & Lamson inspection engineers. They are always ready to study your problems and make recommendations based on more than twenty years experience in this field.

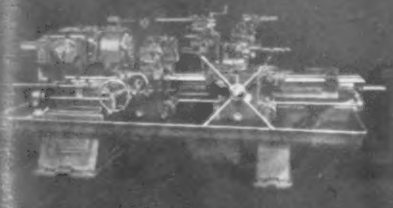


Many of these parts are less than one inch in diameter, the thin separations around their edges are reflected upon the screen at 22 magnifications, and inspected for perfect alignment.

Courtesy Westinghouse Electric & Manufacturing Company

JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U. S. A.

Manufacturers of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies.



SADDLE TYPE
UNIVERSAL TURRET LATHES

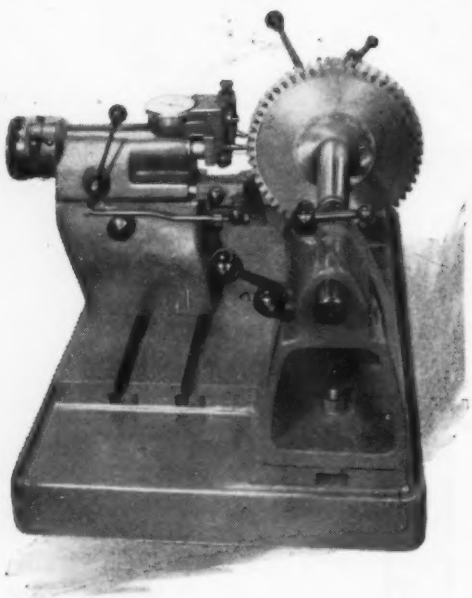
PROFIT-PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHES

New Ease IN TESTIN

OF EXTERNAL SPUR

Every production man handling an output of high-precision gears up to 12 inches pitch-diameter will be interested in these new checking fixtures. The No. 12-C Fellows Cone-Point Testing Fixture, illustrated on the page at the right, is a compact device (28 inches x 18 inches) for use on a bench or stand. Headstock, tail-stock, and the bracket carrying the cone pointer are adjustable longitudinally on the base for handling all gear parts up to 15 inches between centers, and up to 12 inch pitch diameter. The dial indicator reads to 1/10,000 inch, and an indexing mechanism, adjustable for each gear set-up, provides ease and speed in operation. For further particulars, write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, Mich., or 640 West Town Office Building, Chicago, Illinois.



By the simple exchange of interchangeable "measuring" brackets, conversion may be made to a Circular Pitch Testing Fixture—as here illustrated.

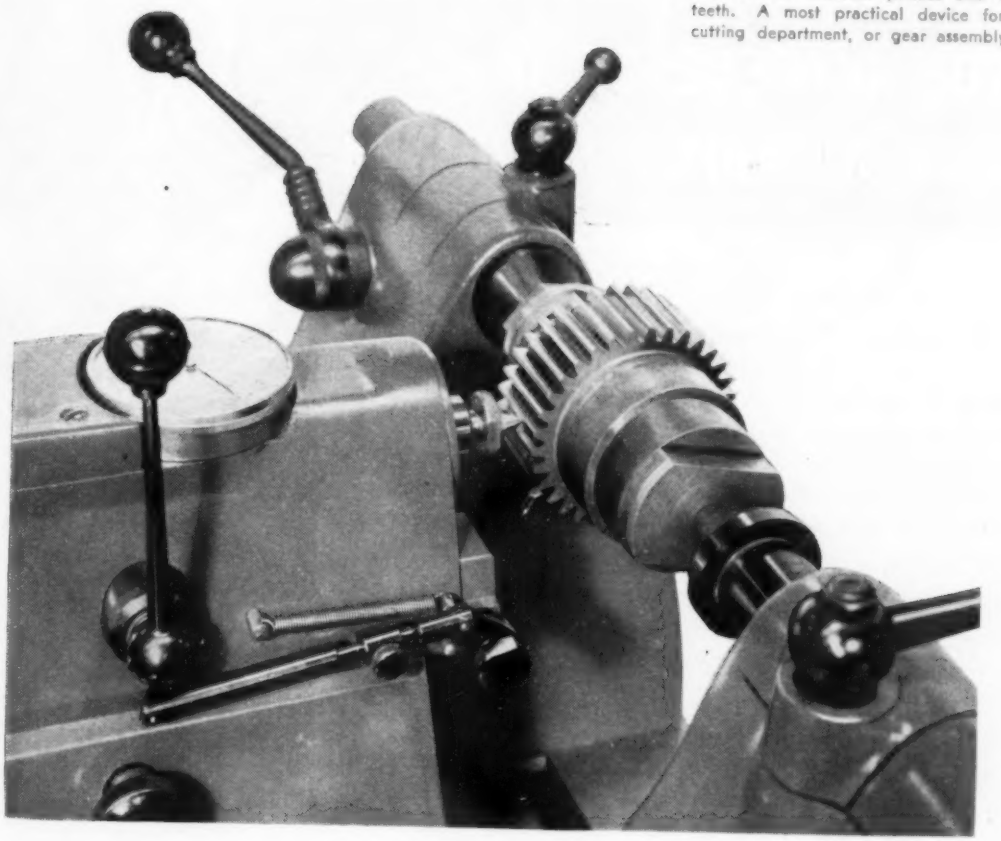
FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTI

TIN CONCENTRICITY

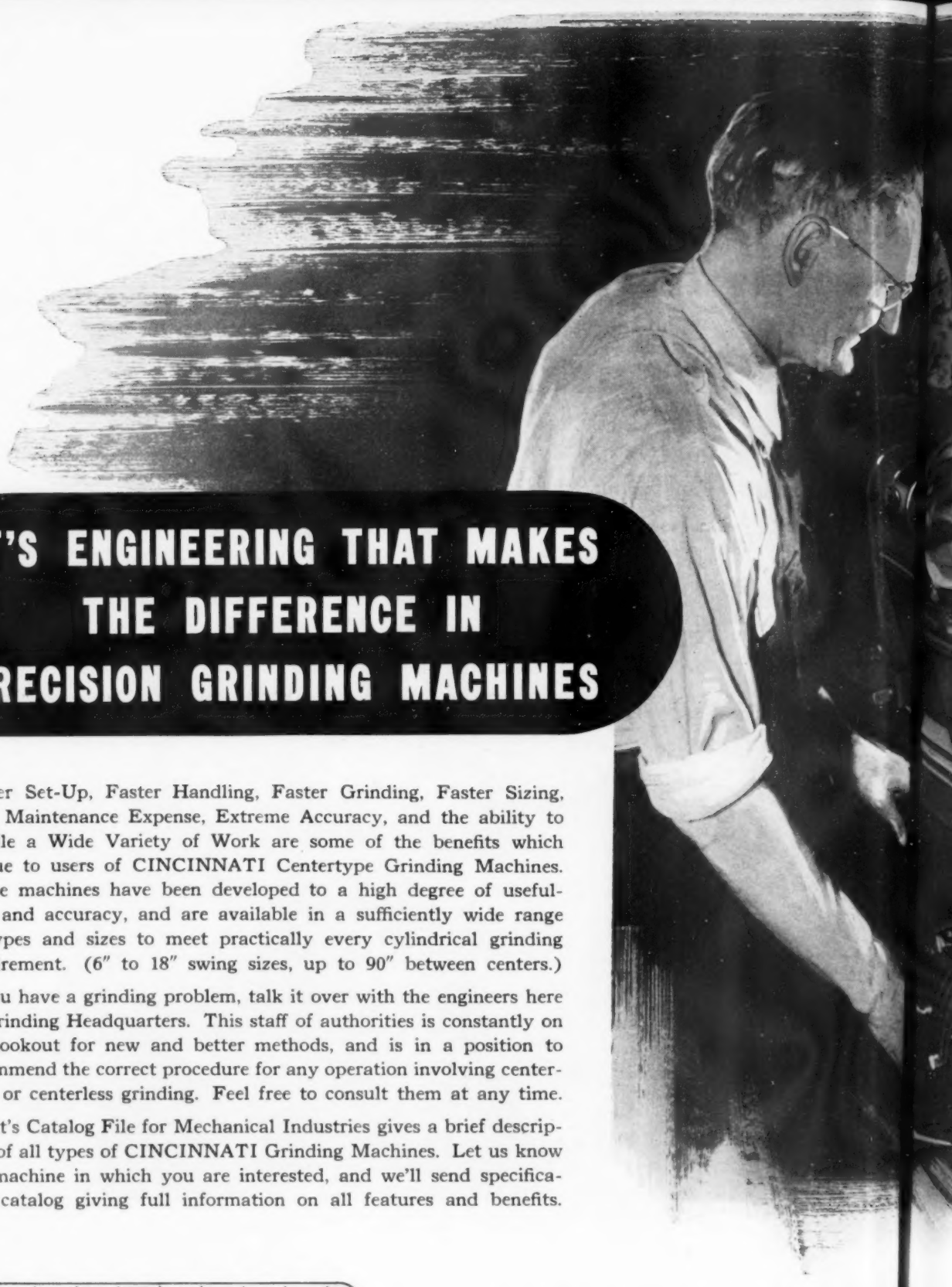
PUR ND HELICAL GEARS

This precision device for gear testing weighs approximately 300 lbs. and is designed and built to retain its original precision under normal conditions of use. Automatic indexing is quickly adjusted for different pitches and numbers of teeth. A most practical device for the gear cutting department, or gear assembly shop.



Method

. . . . FROM BLANK TO FINISHED GEAR

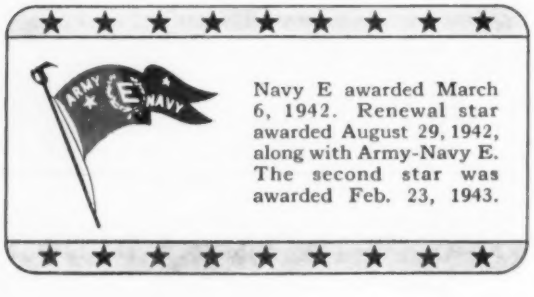


IT'S ENGINEERING THAT MAKES THE DIFFERENCE IN PRECISION GRINDING MACHINES

Faster Set-Up, Faster Handling, Faster Grinding, Faster Sizing, Low Maintenance Expense, Extreme Accuracy, and the ability to handle a Wide Variety of Work are some of the benefits which accrue to users of CINCINNATI Centertype Grinding Machines. These machines have been developed to a high degree of usefulness and accuracy, and are available in a sufficiently wide range of types and sizes to meet practically every cylindrical grinding requirement. (6" to 18" swing sizes, up to 90" between centers.)

If you have a grinding problem, talk it over with the engineers here at Grinding Headquarters. This staff of authorities is constantly on the lookout for new and better methods, and is in a position to recommend the correct procedure for any operation involving centertype or centerless grinding. Feel free to consult them at any time.

Sweet's Catalog File for Mechanical Industries gives a brief description of all types of CINCINNATI Grinding Machines. Let us know the machine in which you are interested, and we'll send specification catalog giving full information on all features and benefits.



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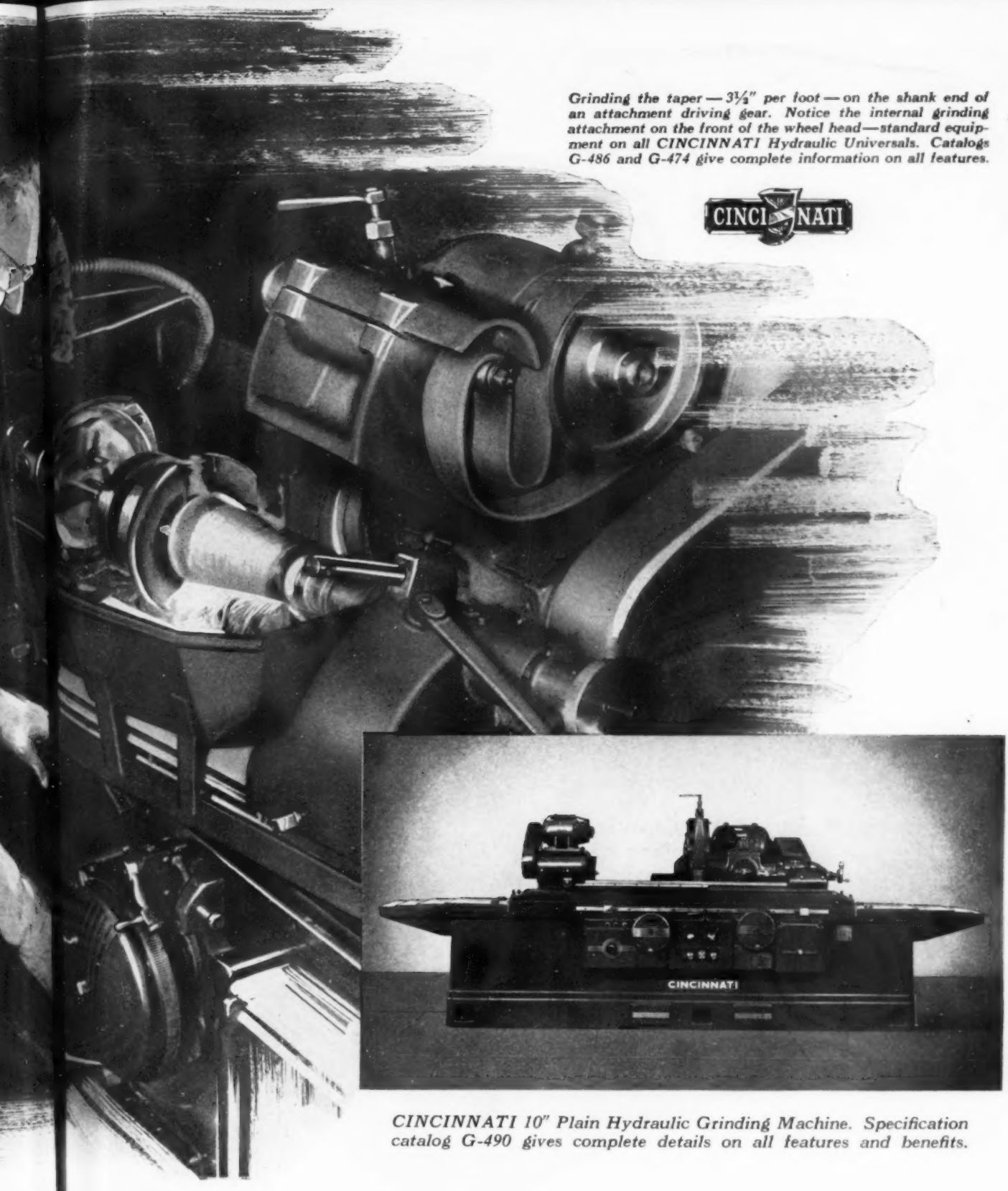
CINCINNATI

CENTER TYPE GRINDING MACHINES



Grinding the taper — 3½" per foot — on the shank end of an attachment driving gear. Notice the internal grinding attachment on the front of the wheel head—standard equipment on all CINCINNATI Hydraulic Universals. Catalogs G-486 and G-474 give complete information on all features.

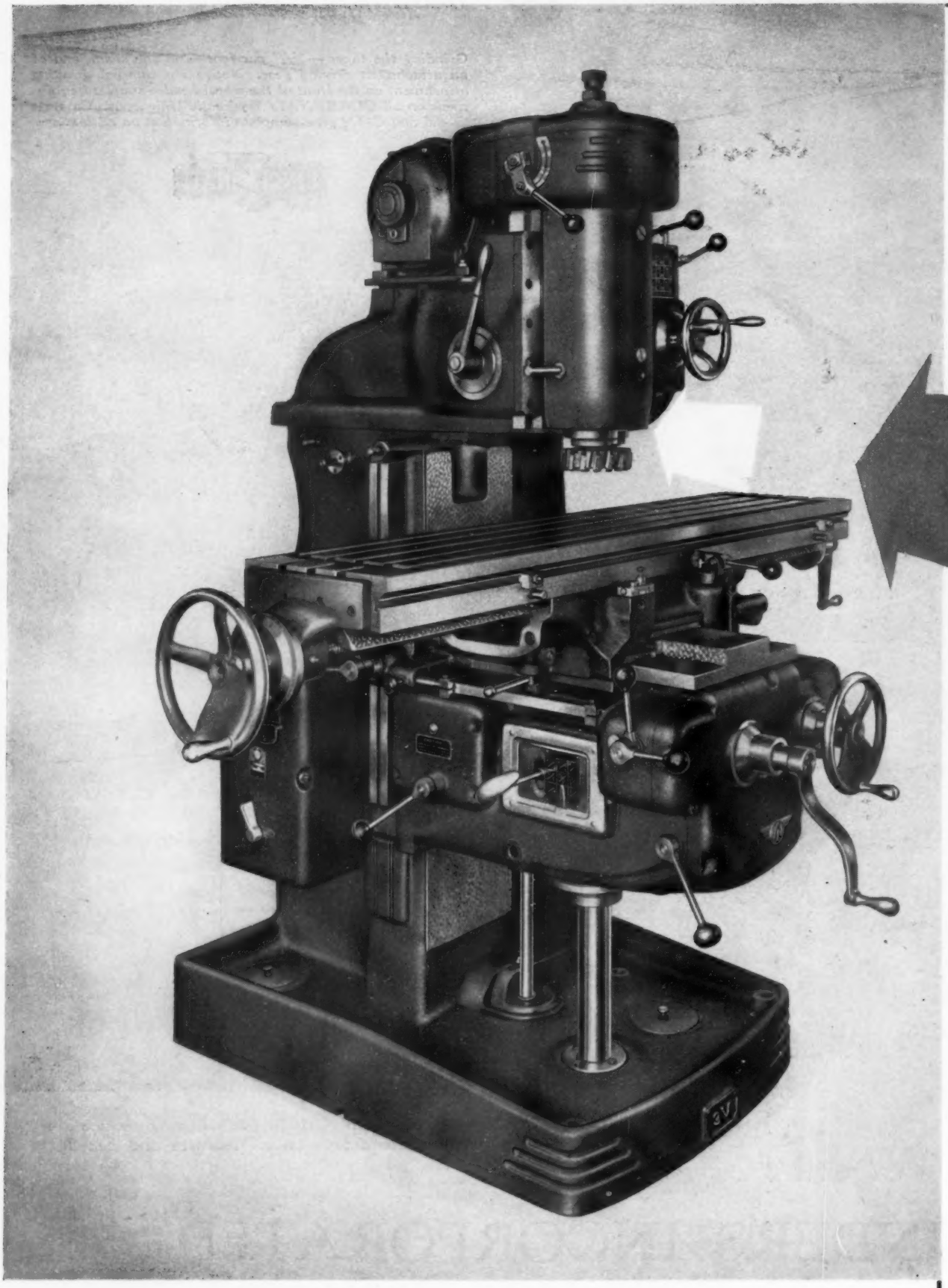
CINCINNATI

CINCINNATI 10" Plain Hydraulic Grinding Machine. Specification catalog G-490 gives complete details on all features and benefits.

AT RINDERS INCORPORATED

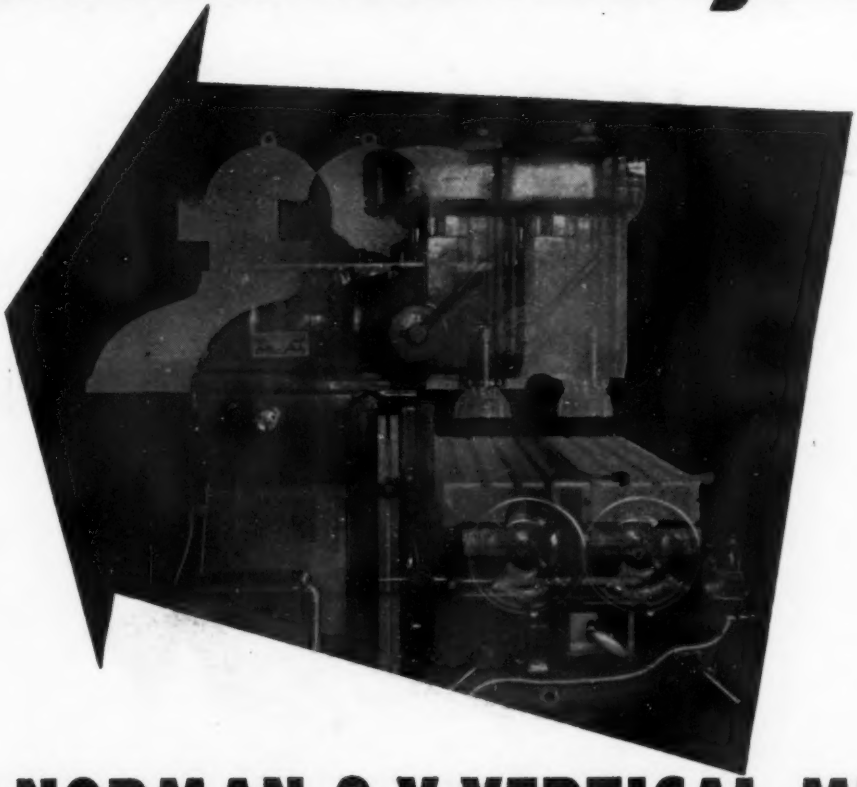
CINNATI, OHIO, U. S. A

CHINE TERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



SPECIFICATIONS: Table: 64" x 14". Vertical Spindle Adjustment: 5".
18 Speeds: 25 to 1250 RPM. 18 Feeds: 3/8" to 32"

SLIDING RAM
Increases Work Range of



VAN NORMAN 3-V VERTICAL MILLER

The Van Norman 3-V Miller is designed and built to provide a greater work range and extreme accuracy on vertical milling operations.

By mounting the cutterhead on a sliding ram, the throat distance can be varied in or out so that the spindle is more closely coupled and solidly locked to the column for any milling job. This means that there is minimum overhang, therefore maximum rigidity is always obtained.

Other noteworthy features incorporated into the 3-V Miller include . . . front and rear directional control of all power feeds and six-way rapid traverse, single lever feed selector. . . quick change speed levers, conveniently located on the front of the ram, instantly providing 18 spindle speeds . . . large, easy-to-read dials. Add to these advantages the extra ruggedness and rigidity of the column, knee, saddle, table, ram, and you'll readily see that the Van Norman 3-V Vertical Miller meets all requirements for accuracy and dependability.

VAN NORMAN MACHINE TOOL COMPANY
SPRINGFIELD, MASSACHUSETTS

It Pays to Van Normanize

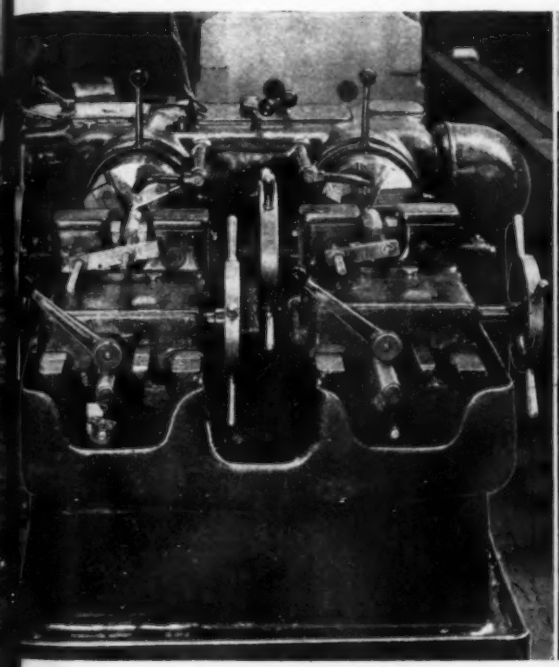
Landis Threads

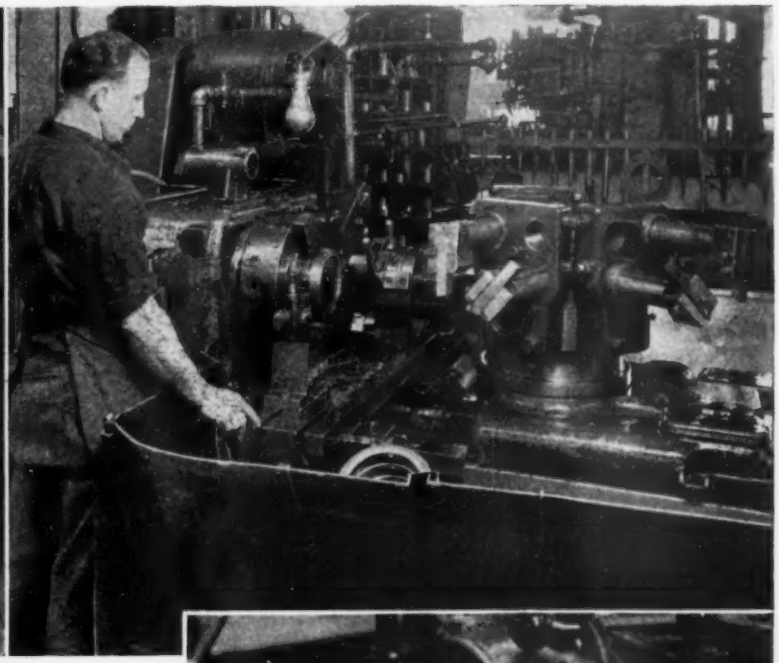
Under the sea, as well as in the air and on the land, Landis Threads are found wherever accuracy is essential.

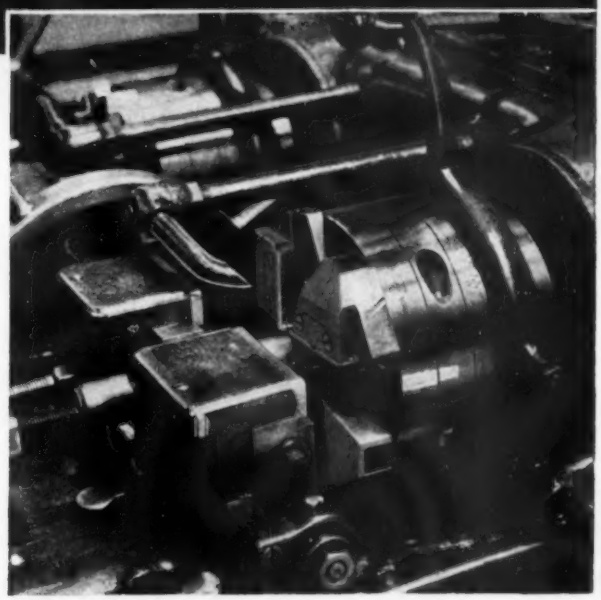
LANDIS MACHINE CO

Go Down to Sea In Our Submarines

Threading Diesel Engine Studs and Valve Parts are but typical of the innumerable Threading Operations Landis Threading Equipment is performing 24 hours a day, seven days a week, for the intricate mechanism of the modern submarine.





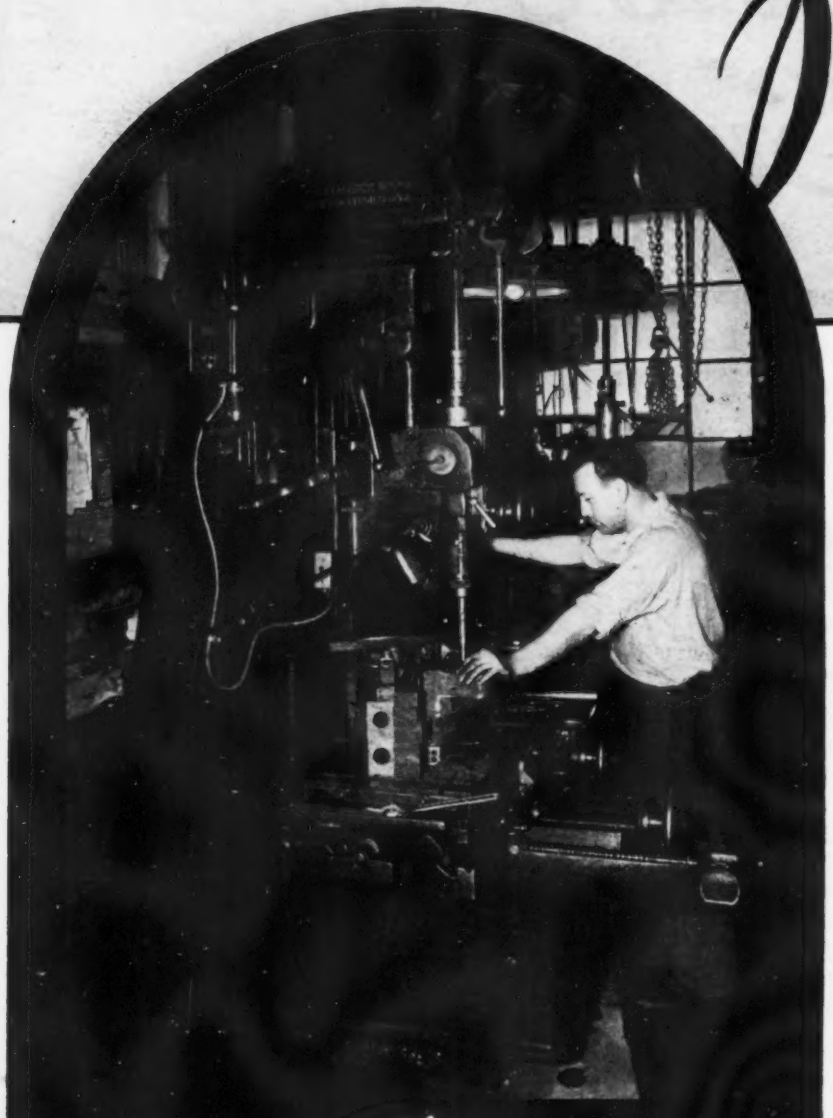


High Production—Accuracy and Quality of Thread — are assured the users of Landis Products. Send for booklet "Be Threadwise."

WAYNESBORO PENNA·U·S·A·

VERSATILITY

A PRIME REQUISITE TO DIE & TOOL SHOP *Production*



The

FOSDICK

JIG BORER

★ The two Jig Borers illustrated at Advance Tool & Die Co. are typical examples of Fosdick Jig Borer versatility—both in range of work they handle and in low cost of operation by the average machine operator.

When you have comparatively small lots on which the cost of jigs and fixtures is prohibitive you will find the Fosdick Jig Borer is not only most adaptable but more economical.

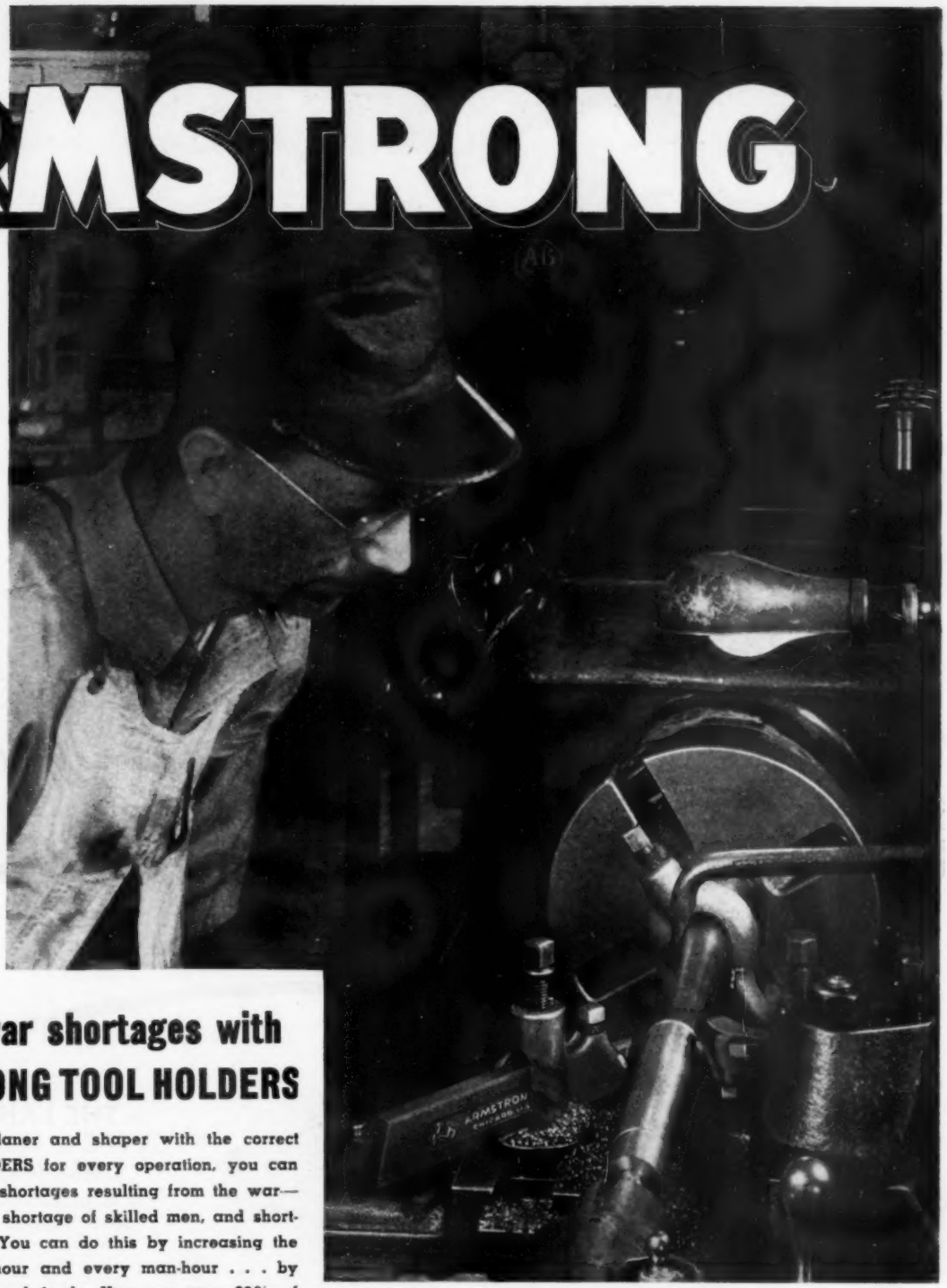
Low in initial cost it has many advantages over more expensive equipment. Centralized controls — versatility — dependable precision on all operations—may be operated by ordinary drill hand —are all factors contributing to greater production and the lower costs available on this modern machine. And it is these features that make it particularly adaptable to tool and die shop operation where its speed and accuracy are meeting the specific needs of war production.

It will pay you to consult a Fosdick Engineer on your next jig borer job. Fosdick Jig Borer Bulletin J.B.A. gives complete information. Write for yours today.

FOSDICK MACHINE TOOL COMPANY

CINCINNATI · · · OHIO

ARMSTRONG



Make up for war shortages with more ARMSTRONG TOOL HOLDERS

By tooling every lathe, planer and shaper with the correct ARMSTRONG TOOL HOLDERS for every operation, you can make up for many of the shortages resulting from the war—shortage of machine tools, shortage of skilled men, and shortage of high speed steel. You can do this by increasing the output of every machine-hour and every man-hour . . . by stepping up both speeds and feeds. You can save 90% of your high speed steel too, because an ounce of high speed steel used in an ARMSTRONG TOOL HOLDER will do the work of 10 ounces in a forged tool.

ARMSTRONG TOOL HOLDERS have strength and efficiency that has obsoleted the "standard cutting speeds" which have been carried over from the old forged tool days. These are in no way a measure of the capacity of modern machine tools equipped with ARMSTRONG TOOL HOLDERS. A few simple tests above the first "vibration" point will usually give you a new basis for estimating your present capacity.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U.S.A.
Eastern Warehouse and Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

IT'S ALL HERE

Some grinding machine troubles are extremely difficult to locate. They are the ones that cannot readily be seen or heard, like grinding wheel out-of-balance, for example. Chapter 6 (only one of eighteen) in the practical book "Better Grinding" quickly explains the mysteries of both mounting and balancing the wheel for the peace of mind of all those who will read. This you may do from your own personal copy by sending in the coupon on the opposite page.

Chapter VI

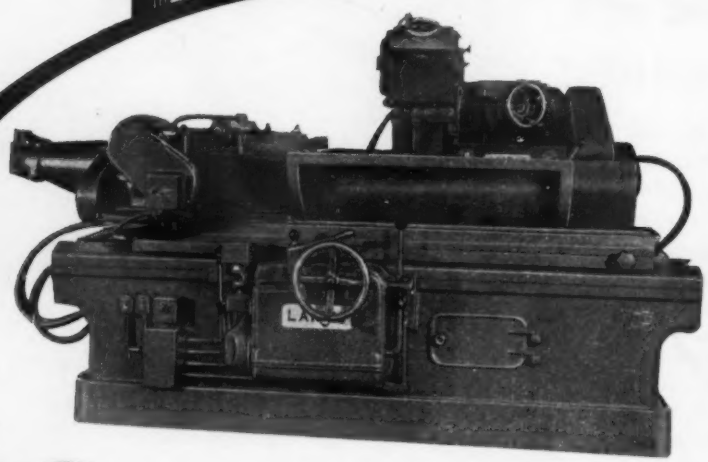
MOUNTING AND BALANCING THE WHEEL

Mount properly and maintain balance. That's good advice when applied to a number of life's activities, not the least of which is the handling of a grinding wheel.

Out of balance wheels cause more trouble than generally suspected. Often this trouble more or less sneaks up on the operator. He might start out with a well balanced new wheel only to find it out of balance after relatively short use. The larger the wheel, the more likely this is to happen and the better the finish required, the more carefully balance must be watched.

Patience is a good virtue to exercise when mounting and balancing wheels. He who does so will be amply repaid.

Scrape out the hole if the wheel does not fit freely, as forcing it on the center may cause it to crack



THE LANDIS 5" TYPE D HYDRAULIC CAM GRINDERS

- Recommended for all types of integral camshafts such as those used in automobile and in-line airplane engines.
- Used by manufacturers of numerous types of internal combustion engines required in connection with the war effort.
- Available in four lengths, namely 26", 30", 36" and 40".

IF YOU HAVE A GRINDING PROBLEM

Let George do it

LANDIS TOOL COMPANY

George Grindit Says
"Ever watch a tight rope walker? When he loses his balance, down he goes. And when your grinding wheel loses its balance, down your production goes. Even though this old world is considerably out of balance right now, grinding wheels dare not share the same fate."
PRECISION
LANDIS
GRINDERS

THE CHAPTERS

Work Centers and Centers in the Work . . Work Drivers and Driving Dogs . . Work Rests . . The Diamond . . Wheel Dressing and Wheel Truing . . Mounting and Balancing the Wheel . . Grinding Wheel Coolant . . Lubrication . . Multiple V Belt Drives . . Wheel Spindles and Bearings . . Grinding Wheel Feed . . Grinding Wheel Width . . Speed of Work Carriage Traversal . . Work Speed . . Grinding Wheel Speed . . The Grinding Wheel . . Chatter . . Miscellaneous Bits.

Please Send Me a Free Copy of . . .

"BETTER GRINDING"

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ 6

Please Print Above and Send To

LANDIS TOOL CO.

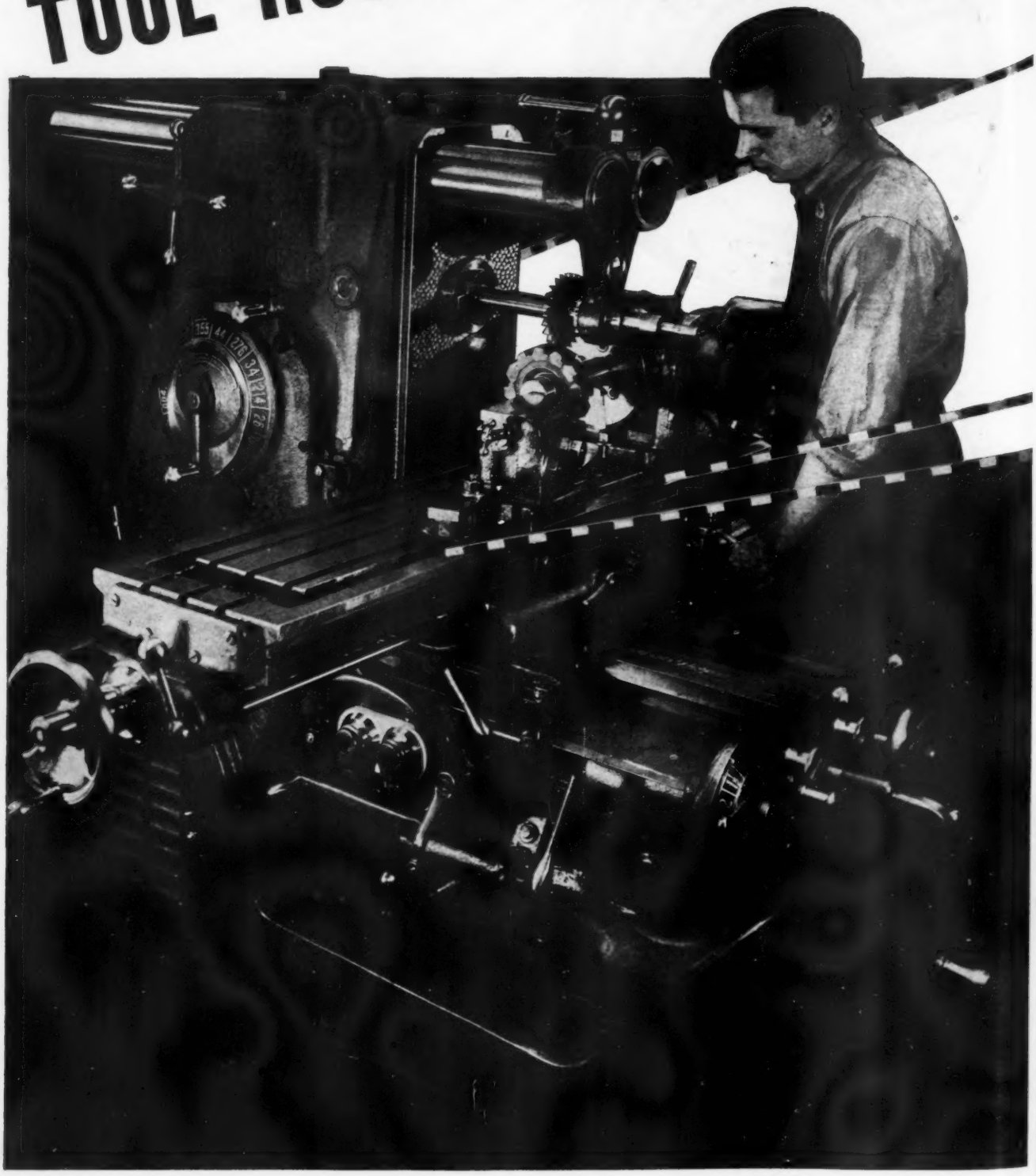
WAYNESBORO, PENNSYLVANIA

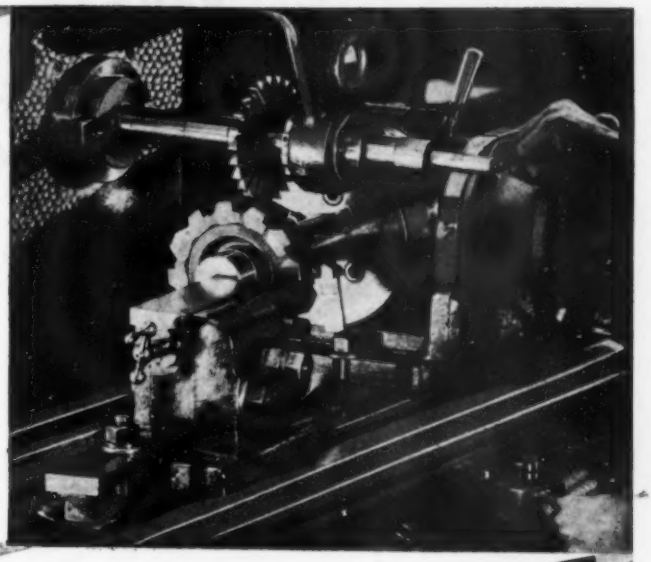
WAYNESBORO, PENNSYLVANIA

Make it

in your TOOL ROOM

. . . Here's Another Job Showing How Time and Trouble can be Saved by Doing it in *YOUR TOOL ROOM* —on a *MILWAUKEE UNIVERSAL*





Only a half hour to convert an old inserted-blade face milling cutter to a modern tool — fitted with tungsten carbide tips!

The job required remilling for T-C tip slots — 7° negative rake, 7° positive angle. There were four face mills in the lot — 12-tooth cutter bodies of hardened Meehanite — and only a half hour was needed to remill each cutter on a Model H Milwaukee Universal.

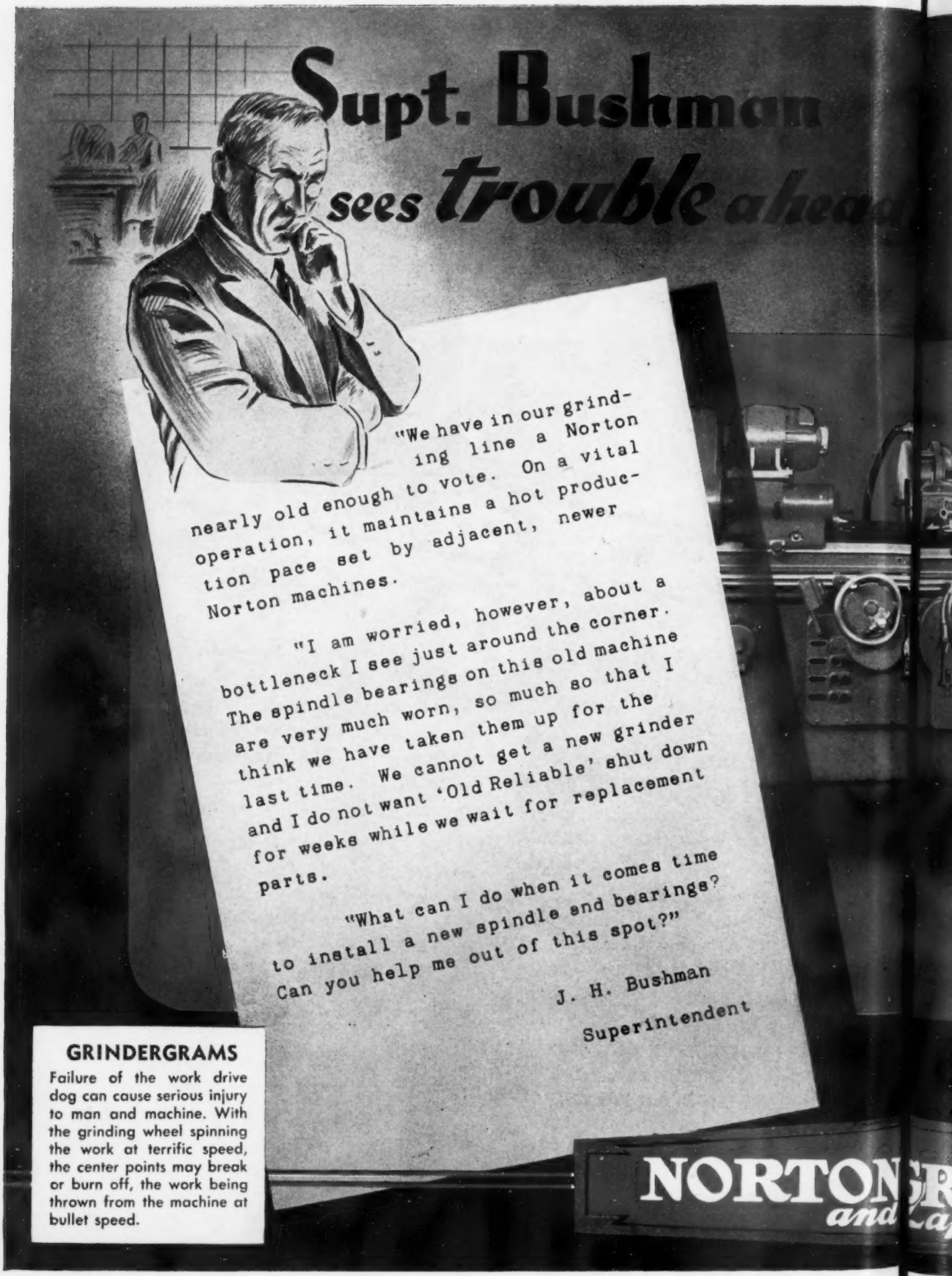
That's just another example of the flexibility and adaptability of Milwaukee Universals in the tool room — doing a greater variety of jobs — faster — and without special equipment.

And it's another instance of how troubles caused by tool steel shortages — long delayed delivery dates — can be avoided by remaking — reshaping — reconditioning tools on a Milwaukee Universal Milling Machine.

"BUY VICTORY WITH AT LEAST 10% IN WAR BONDS"

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

Milwaukee **MACHINE TOOLS**


Supt. Bushman sees trouble ahead
"We have in our grinding line a Norton nearly old enough to vote. On a vital operation, it maintains a hot production pace set by adjacent, newer Norton machines.
"I am worried, however, about a bottleneck I see just around the corner. The spindle bearings on this old machine are very much worn, so much so that I think we have taken them up for the last time. We cannot get a new grinder and I do not want 'Old Reliable' shut down for weeks while we wait for replacement parts.
"What can I do when it comes time to install a new spindle and bearings? Can you help me out of this spot?"
J. H. Bushman
Superintendent
GRINDERGRAMS
Failure of the work drive dog can cause serious injury to man and machine. With the grinding wheel spinning the work at terrific speed, the center points may break or burn off, the work being thrown from the machine at bullet speed.
NORTON

again the NORTON *"doctor"* PRESCRIBES

WE HAVE worked out a neat wrinkle to take care of that problem, Superintendent Bushman. It is an outgrowth of our studies on the conservation of essential wartime materials.

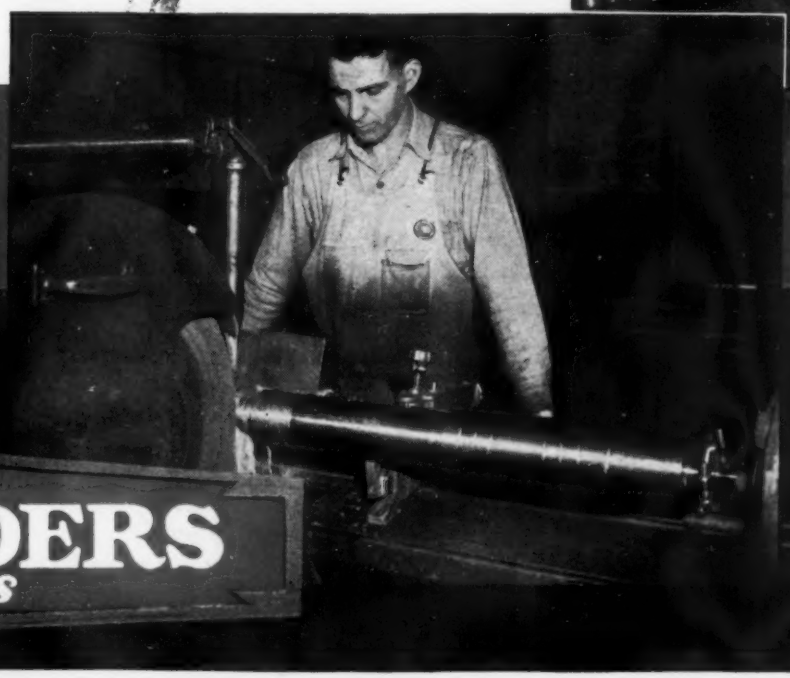
Shut down your machine when the time comes and donate the old bearing boxes to your local Scrap Salvage Drive. Send us your wheel spindle for reconditioning. We will supply new bearing boxes from our extensive stocks and bore them to fit your reconditioned spindle. You will have the whole outfit back in your hands, *and Old Reliable running again,* in a fraction of the time required in these busy days to make a new spindle and fit it to standard bearing boxes.

Perhaps you, too, are worried about worn spindle bearings on an old machine. You will actually save money for your company, vital production time for Uncle Sam and we will conserve our precious stock of vital spindle steel if you also follow this advice.

Over a period of years, in good times and lean, Norton Company has worked out a system of grinder maintenance of which we are proud. It is said, "A Norton grinder never wears out." We are able to supply replacements for practically any of the nearly 35,000 Norton grinders built in the past two score years. In these days of priorities and bottlenecks on machine tools, we can be of material assistance to you and your war production when you must recondition your older Norton grinders.

NORTON COMPANY, WORCESTER, MASS.

M-458



GRINDERS
Lappers

FIFTH COLUMNISTS

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

Cover the Turning Field

...ts on the Records

TIME is the essence, now. Multiple shifts are doubling and tripling output. First costs of mechanical equipment are being absorbed two or three times as fast as normally. By the same token, utility values of machines decrease in like proportion, with increased working hours, overloading and less preventive maintenance.

IF NOT STUDIED and acted upon, false book values and cost figures set up by these conditions could readily sabotage postwar planning. Unheeded and uncorrected, they could become dangerous fifth columnists, bring financial disaster.

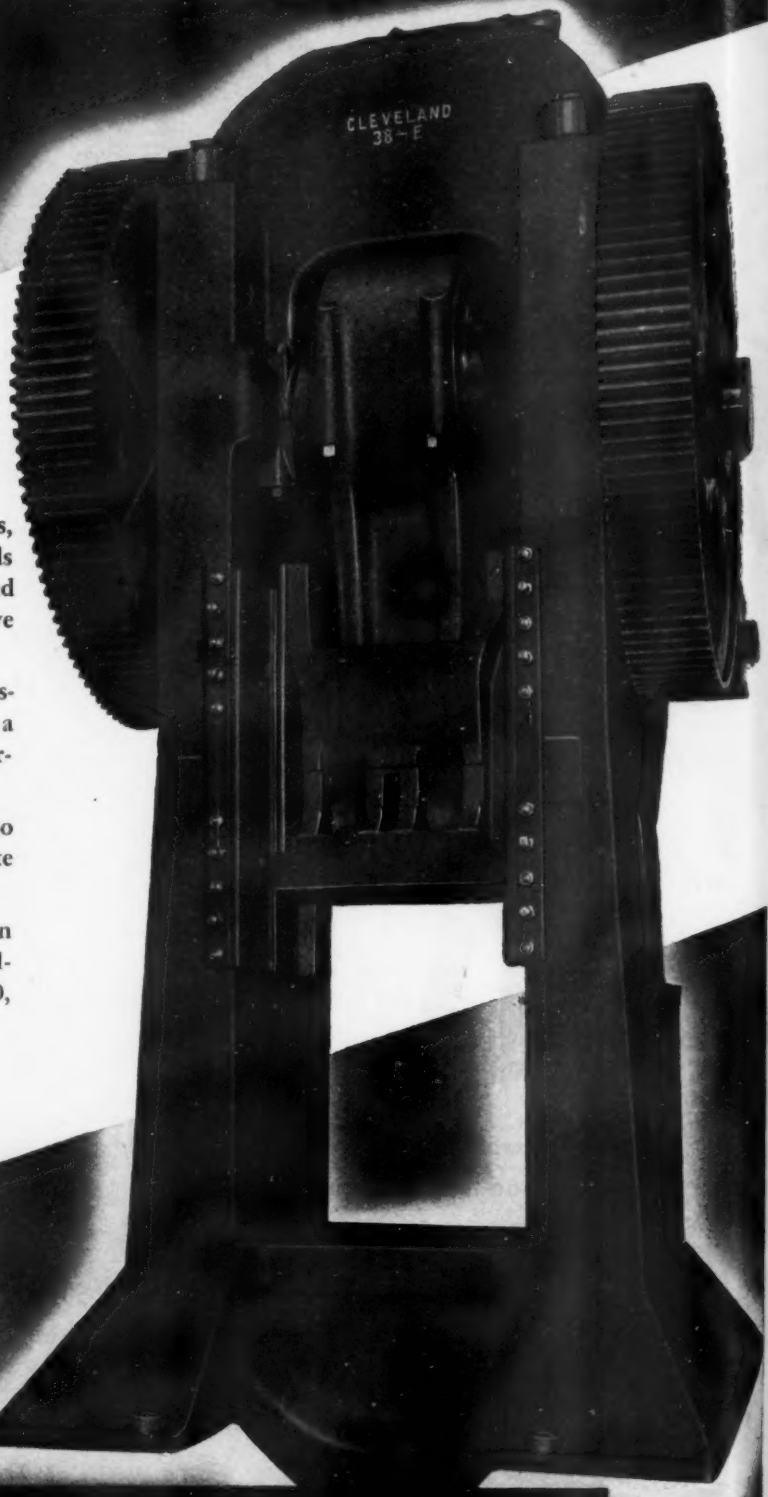
OBSOLESCENCE, too, is taking its toll. Many machines that are fully adequate for current work may be completely unfitted for postwar production. New processes, new materials, changes in line or designs may necessitate basic changes in production setups.

WE SHOULD scrutinize *normal* costs and outputs of mechanical tools to see whether they offer ample utility with "business as usual." Will they deliver, in cost and quality, products that can be sold against world-wide competition?

TAX AUTHORITIES, too, should recognize these facts. Faster depreciation should be allowed for machines which are being driven so hard, or which may rapidly become obsolete. This will permit the reservation of "seed money" now, for replacements when needed and available.

IF VICTORY is to bring work and prosperity, we must rid our bookkeeping of these unintentional fifth columnists, which are as dangerous in business as willful sabotage is in war.

MORE POWER to our ARMED FORCES



This Cleveland 38 E, Single Eccentric Press, is but one of the many types of Clevelands which are being used to provide our armed forces with the means to wage offensive warfare.

This powerful "war worker" exerts a pressure of *2400 tons* and is equipped with a two station electrically controlled, air operated friction clutch.

The Press is arranged for twin drive to the eccentric shaft and operates at the rate of 20 strokes per minute.

Other Presses of this particular type can be furnished in various sizes and in the following capacities: 160, 185, 220, 315, 600, 830 and 1350 tons.

Modern Presses

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

PHOTO BY U. S. ARMY AIR CORPS

RTS... and STILL MORE PARTS FOR
LANES AND STILL MORE PLANES...
That's part of the contribution
to production being made by

P&J Automatic CHUCKING EQUIPMENT

Duplicate parts for airplanes, airplane engines, tanks, guns, adaptors for shells and other armament products are being made to closest limits of accuracy on P & J equipment. Precise work is being handled at high production rates on these fast, convenient, powerful machines.

The versatility of tooling on P & J machines has enabled P & J engineers to develop set-ups which clip vital minutes from the time required by conventional methods. Overall results—in terms of more and better work in less time—have demonstrated the value of the service rendered by P & J engineers—a service available without obligation and made possible by Potter & Johnston's long experience in the development of automatic chucking equipment.

The POTTER & JOHNSTON MACHINE CO.
Pawtucket, R. I.

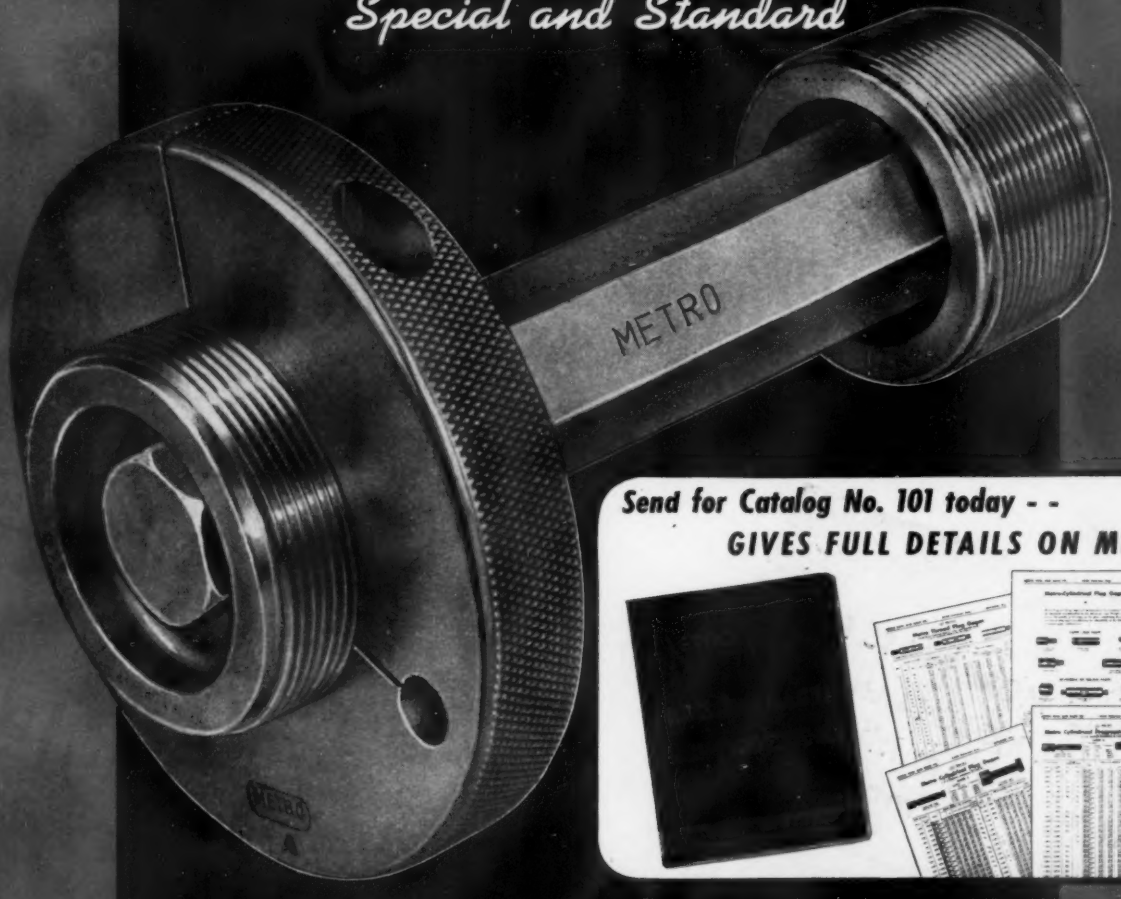
WAR SAVINGS BONDS WILL HELP—
BUY THEM, BUILD THEM and FLY THEM

INVEST NOW

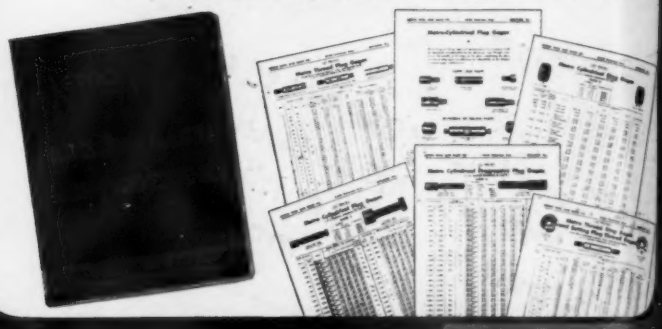
PRECISION GAGES

THREAD AND PLAIN PLUG AND RING GAGES

Special and Standard



Send for Catalog No. 101 today - -
GIVES FULL DETAILS ON METRO LINE



• Metro Precision Lapping Department where sizes are held to eight millionths of an inch.

• Inspection is done in an air-conditioned room where temperature is kept at 68° F.

• Part of Metro's Modern Machine Shop where highest accuracy and precision is maintained.

METRO

TOOL AND GAGE CO

4240 PETERSON AVE.
CHICAGO, ILL.

THE NIGHT OF JANUARY 21st

It happened barely two years ago — on January 21, 1941 — and already it is changing the shape of the world. On that night, men held in their hands a bar of the world's lightest metal — the first ingot of pure magnesium to be taken from the sea.

The men were chemists and engineers of Dow Chemical Company, and the metal mermaid which they held that night was the creature of many years of experiment in the field of ocean mining. As a result of those years of search and research, most of our production of over 200 million pounds of magnesium this year will come from the limitless sea, and plants are building for the production of many times that amount. . . . Also as a result of those years, a whole new age of light metal parts, products — and problems — has begun.

Today, 99 per cent of all magnesium production is going into aircraft. But after this war, with a wealth of experience, new techniques and a yawning capacity, magnesium will be ready to bid for other markets: streamliners, busses, trucks, trailers, engine forgings, household appliances, building materials, and the whole broadening field where weight and load factors are of increasing importance. And with this new production will come the problems.

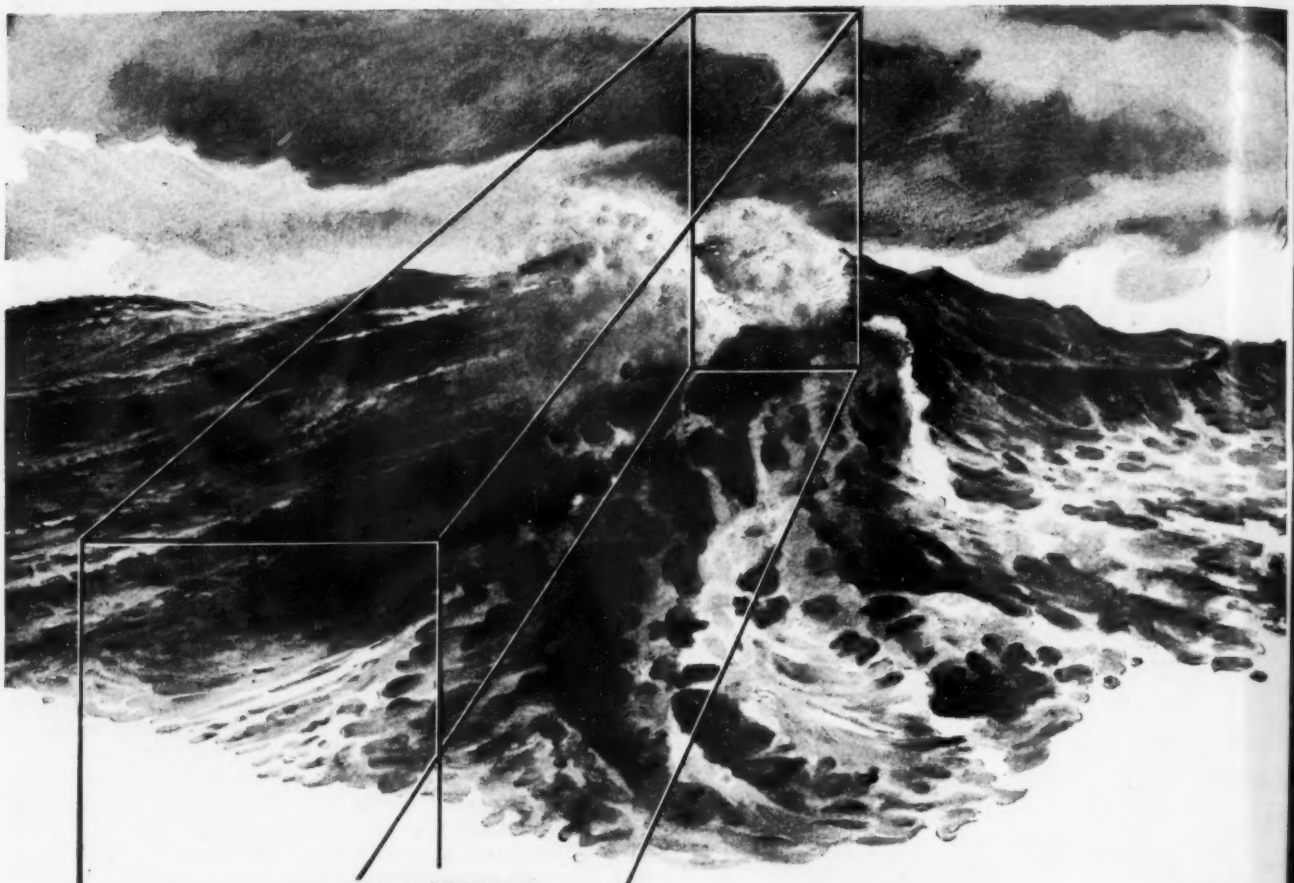
As specialists in internal grinding — with engineers and machines on nearly every aircraft production line in America — we at Bryant have had a great deal to do with parts made from lightweight metals.

We believe that this knowledge can be of greater value to you than ever before in meeting today's efficiency requirements and in planning ahead for tomorrow's. Bryant's Consulting Service is available to you at all times. Call upon us now!

Bryant Chucking Grinder Company

SPRINGFIELD, VERMONT, U. S. A.

SEND FOR THE MAN FROM BRYANT!



THE BRICK THAT SAVED A THOUSAND SHIPS

Dehydrated food saves shipping space.
Compressed dehydrated food briquettes
Save still more space.
Thus, one supply ship can now carry
The food equivalent of ten supply ships . . .
And each ship can provision ten times
As many soldiers as ever before.
Air conditioning and refrigeration equipment
Makes possible these dehydrated food bricks . . .
Dependable and efficient cooling equipment
Provided by General Electric. After the war,
When air conditioning and refrigeration
Will again become available to the public,
Take advantage of G-E experience
In the fields of air conditioning and
Commercial and industrial refrigeration . . .
Turn to General Electric.
Air Conditioning and Commercial Refrigeration Department, Division 435, General Electric Co., Bloomfield, N. J.

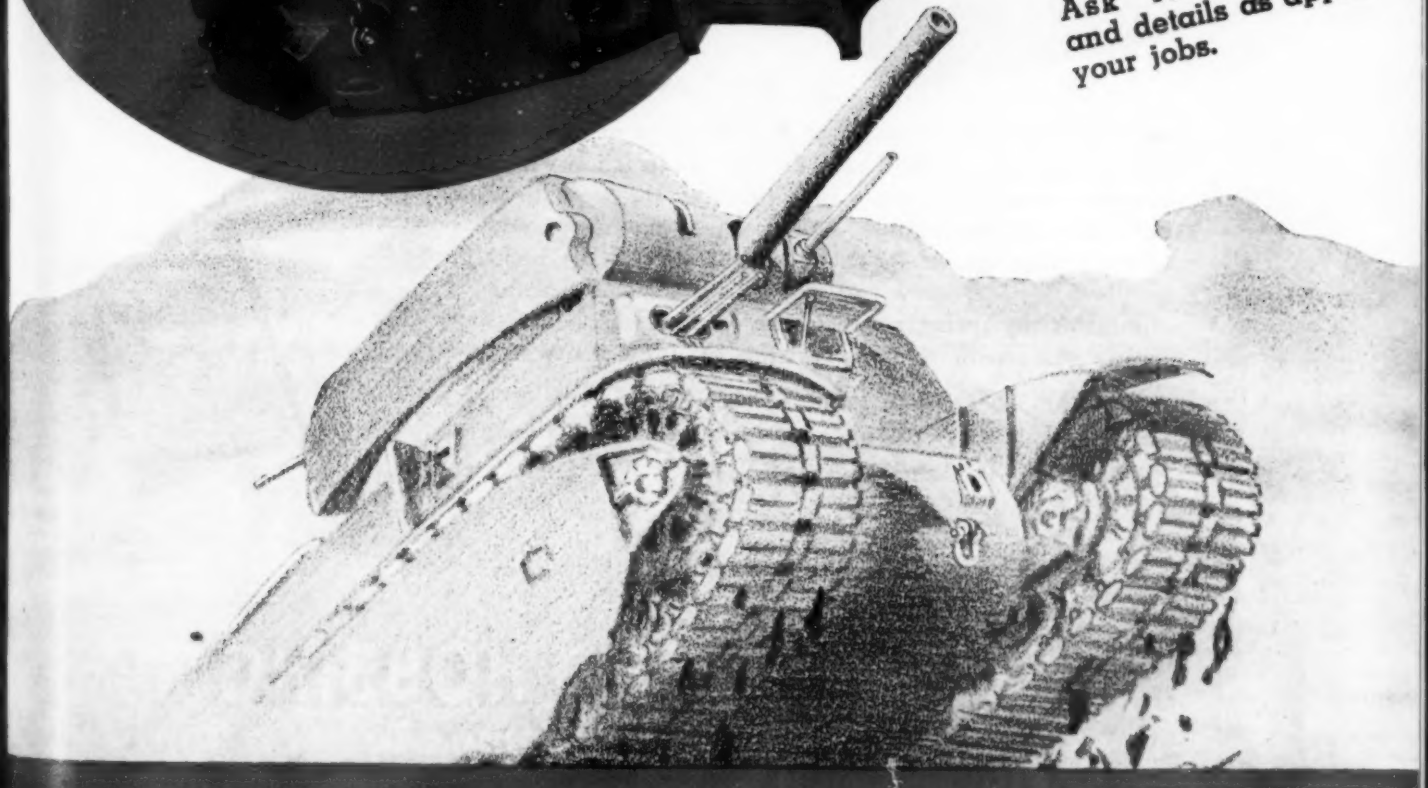
Air Conditioning by **GENERAL ELECTRIC**

You Should Know—

Today hundreds of America's humming factories are beating their quotas of war weapons, by the use of Bullard Mult-Au-Matics.

These machines are not only holding the close tolerances required in all the tools of modern war, but are also setting the remarkably high rates of production. Their rigid construction assures maintained accuracy on around-the-clock running with minimum time out for maintenance.

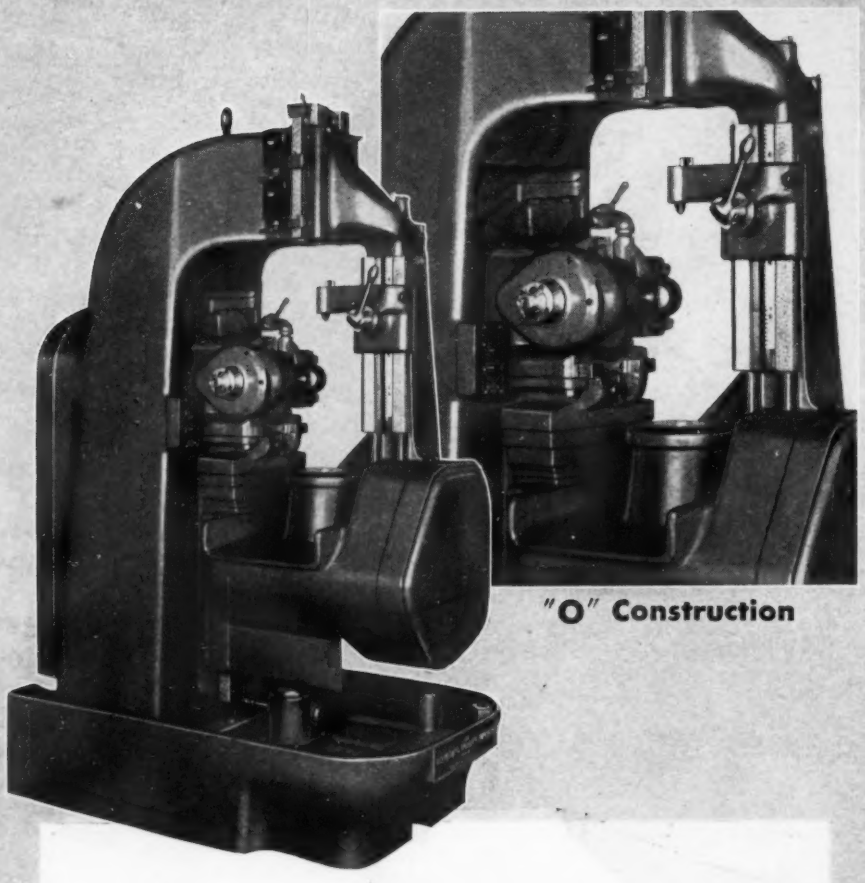
These facts will apply to the new Type "D" 34-Inch 4-Spindle Mult-Au-Matic with six operating heads, which is now being offered for larger capacities of chucked work—crankcases, end shields, larger gear blanks, etc. Ask for Specifications and details as applied to your jobs.



THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

The RIGIDHOBBER
ASSURES DUPLICATE ACCURACY OF Hobbed Gears AND Splines



"O" Construction

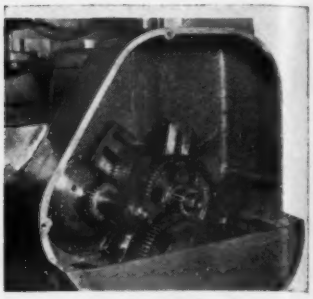
● Rigidity is the keynote of Rigidhobber design and construction. For example note the "O" construction which provides maximum rigidity by supporting the work head both above and below work. The workhead moves vertically and hob cuts against its entire weight eliminating backlash between lead screw and nut. This sturdy construction eliminates any spring either in the work or the hob and assures the utmost in the precision of duplicate work.

The Rigidhobber is also built in 8 spindle rotary models for those plants requiring dependable duplication on a high production basis.

★

HOBBING HELPS FOR BOOSTING WAR PRODUCTION

★



GEARS

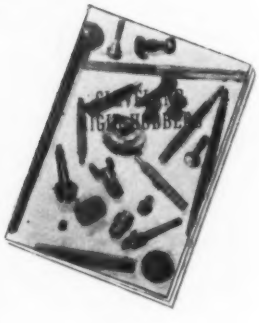
The index and feed gears are located in one case where they constantly run in oil. These gears are of the same pitch and have the same bore and keyway so that feed and index gears may be interchanged and reducing the number of change gears to be stocked.

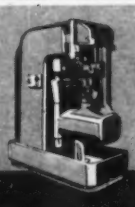
An additional feature of this gear case is that change gear setups can be made without draining the oil. This may be done by removing only the upper section of the cover which leaves an opening through which the gears are easily accessible.

For a very flexible gearing setup, gears from 20 to 100 teeth in increments of one tooth can be used.

This bulletin tells all about Rigidhobbers what they are—how made—and how they can help you increase production.

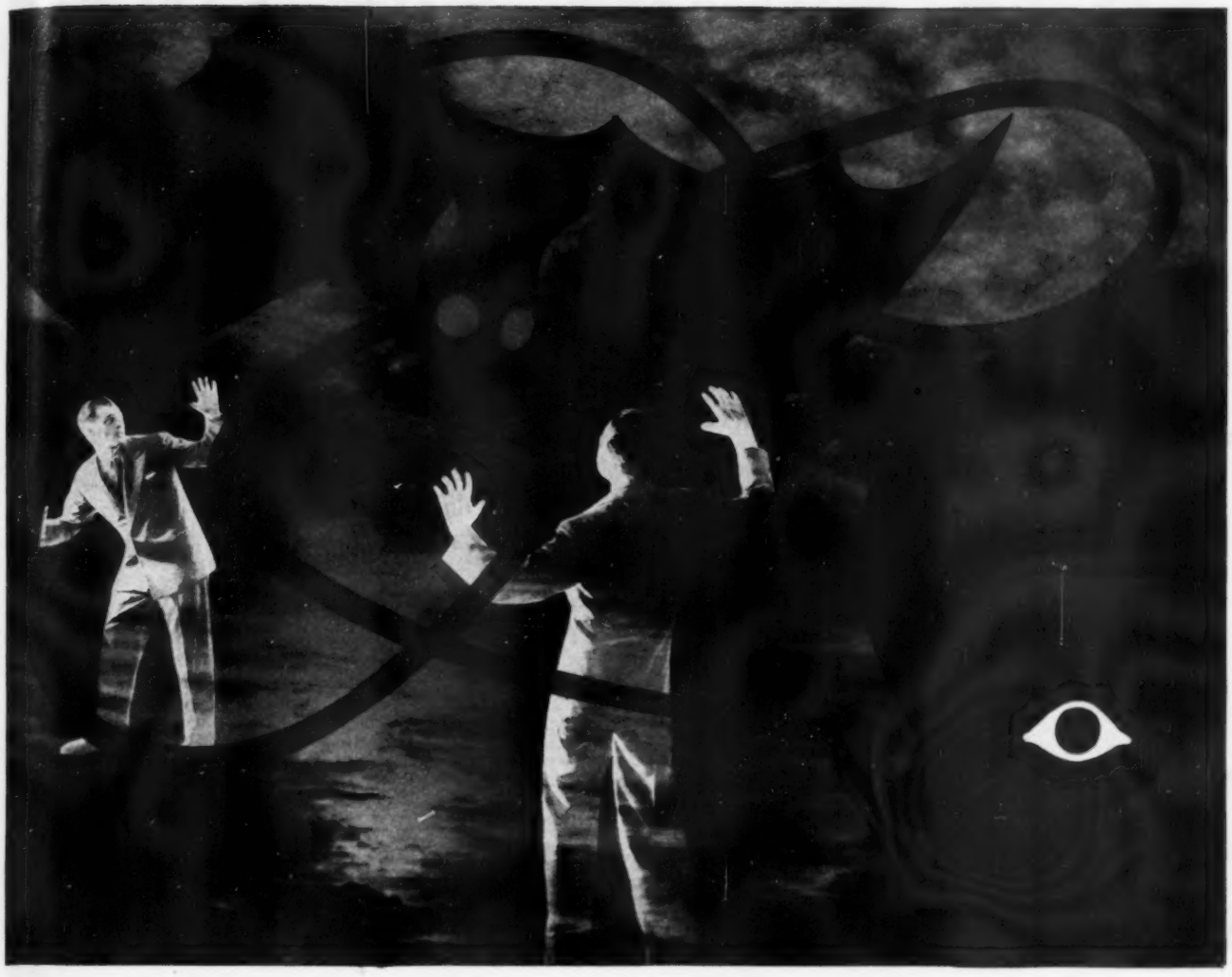
Write for one—now.





The CLEVELAND HOBBING Cleveland ... MACHINE Company ... Ohio

BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS



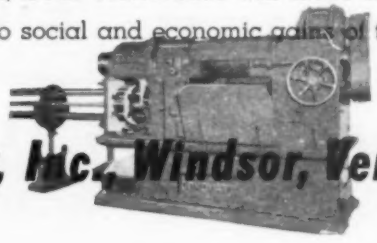
The creature no one knows...

IN THE HALF-WORLD between day and night, an eerie, sinister creature emerges from hiding. Its ancestry is unknown. It is the bat, the only mammal which flies. Of all the creatures known to man, bats are the most mysterious. They do not mate when other animals do. And no one knows where they go at migration time.

Yet bats are the most highly specialized mammals on earth. If we had the intricate ears of bats, we could hear an ant walking. If we had their incredible coordination, we could fly at the speed of a locomotive toward a telephone wire...at dusk...yet miss it! Or dash blindfold around hundreds of objects and not touch one!

But if you think **that's** specialization, listen to this: The production giant of the machine tool industry—Cone's multiple spindle automatic lathe—can do as many as 8 different jobs simultaneously...in a matter of seconds...or perform as many as 17 different operations on a part—more than one every two seconds—with the deftness of a master craftsman!

The prime task of Cone Automatic Machines today is to help speed war production. In the future, by making possible increased production, they will increase purchasing power...and so increase employment. As a result, Cone Automatics will make major contributions to social and economic gains of the future.



CONE Automatic Machine Company, Inc., Windsor, Vermont

LINES BEHIND THE LINES

FROM THE RAILROAD INDUSTRY'S PRODUCTION LINES COMES A VARIETY OF "ROLLING STOCK" TO BACK UP THE FIRING LINES

Intensifying production of vitally needed transportation equipment is just one of the railroad industry's war assignments. To it has been intrusted the added task of producing many other types of war matériel. Where seconds count and precision is at a premium, the railroad industry relies on broaching—a better way to do many metal working jobs, the only *right* way to do some!

This big tank turret gear, taller than a six-foot man, is economically and automatically broached on an *American* surface broaching machine. No special skill is needed. One operator, one machine, and tooling by *American*—equal a precision job at a production rate!

Three internal teeth are cut and finished with each pass of the tool. At completion of the stroke the broach is hydraulically withdrawn from the cut, and the gear is indexed to next working position during the upward stroke. When the 348 teeth are finished the machine automatically stops, permitting easy and rapid reloading of a new blank.

BROACHING IS BETTER THE *American* WAY

American
BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

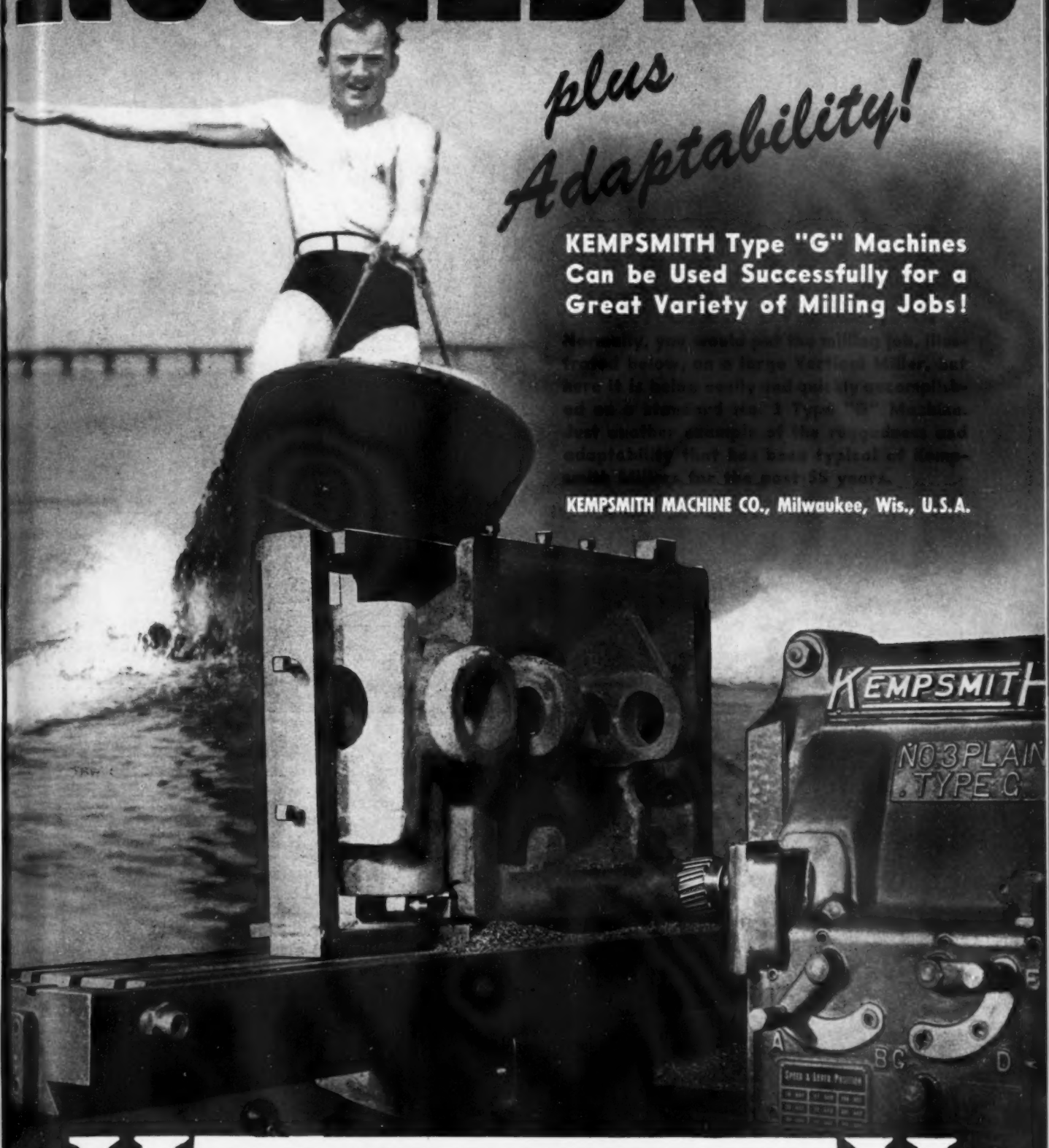
DIVISION OF SUNDSTRAND MACHINE TOOL CO.

RUGGEDNESS

plus Adaptability!

KEMPSMITH Type "G" Machines Can be Used Successfully for a Great Variety of Milling Jobs!

KEMPSMITH MACHINE CO., Milwaukee, Wis., U.S.A.



KEMPSMITH

Precision Built Milling Machines Since 1898

BACK OF THE PLANES AND TANKS AND GUNS

All of the South Bend Toolroom Lathes, Engine Lathes and Turret Lathes are described in Catalog 100C. Write for a copy of this new, 48-page catalog.

Buy War Bonds!

Back of the planes and tanks and guns that are flowing in ever-increasing quantities to our fighting forces is a skillfully coordinated plan of men and machines — a combination of skill, ingenuity and mechanical perfection that is going to win.

Accuracy is the key to the success of this great plan. Without the split-thousandth tolerances that assure perfect interchangeability of parts, the production goals could not be attained — and not enough planes and tanks and guns would reach the war fronts.

Capable of fulfilling the demands of urgent war production, South Bend Lathes have the accuracy and speed for the most exacting precision operations, plus ruggedness and power for efficient service.

South Bend Lathes are made with 9″, 10″, 13″, 14½″, and 16″ swings in both Quick Change Gear and Toolroom models. Practical attachments are available for special classes of work.

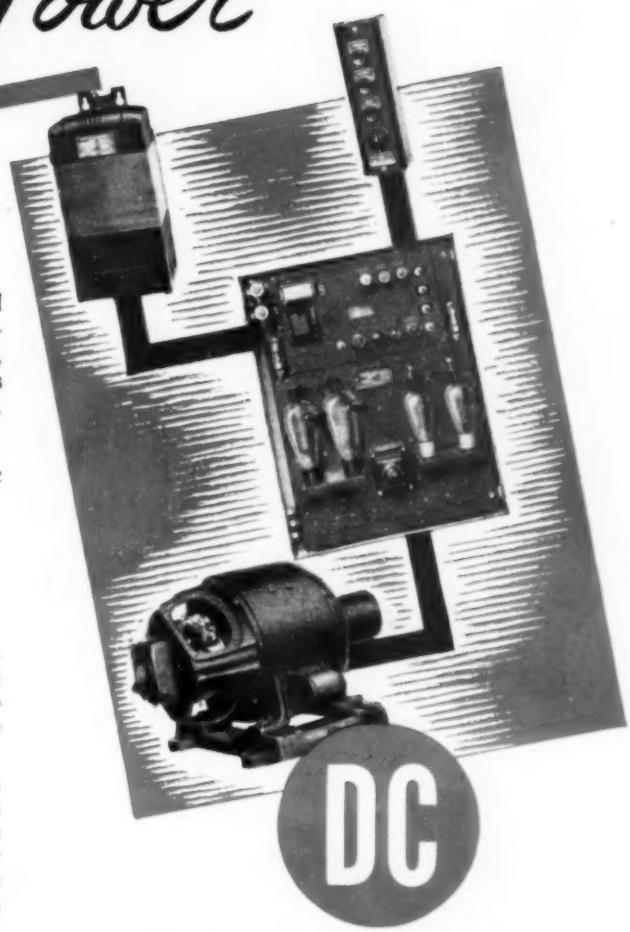
Army-Navy Production Award With Two Stars

ARMY E NAVY

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA — LATHE BUILDERS FOR 36 YEARS

Now Electronics Gives You Full-range Variable-speed Drive from AC *Power*



THY-MO-TROL DRIVE is easy to install. These four compact units—d-c motor, electronic panel, compact control station, and small power transformer—make up the complete drive.

G-E THY-MO-TROL DRIVE Provides Full Control on a Single Dial

- **Complete Drive—Nothing Else to Buy.** Thy-mo-trol drive is a complete equipment, its d-c motor operating from your a-c power line. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single, compact control station. And it fully protects the motor.

  Makes available previously unused advantages of d-c motors, such as:

  1. **Full-range, Stepless Speed Control**
  2. **Constant Speed under Changing Load**
  3. **Full Torque at Low Speeds**
  4. **Smooth, Fast Current-limit Acceleration**

- **Dozens of Other Thy-mo-trol Extras . . .** such as: low maintenance (by elimination of moving parts); preset speed before starting; space saving; no stop for speed change; easy to control automatically; operation direct from a-c line—no motor-generator or other special d-c supply needed.

- **Where Has It Been Applied?** Drill presses, to increase speed range and kinds of work handled. Grinders, for precise speed selection and improved finish. Milling machines, to increase variety of work handled, and to simplify design. Propeller governor testing, for accurate, smooth speed control. Cable reelers, to maintain constant tension. Conveyors, to match speeds.

- **How to Buy Thy-mo-trol Drive.** Because electronic motor control offers so many advantages through improved machine design, performance, and operating technique, G-E engineers want to consider each of your problems as an individual case. Standard Thy-mo-trol drives can be obtained in sizes up to 10 hp. Special types can also be provided. For further information write, stating your problem, to any G-E office, or to General Electric, Electronic Control Section, Schenectady, New York.

ANOTHER G-E *"FIRST"* IN INDUSTRIAL ELECTRONICS

GENERAL ELECTRIC

876-103-8930

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

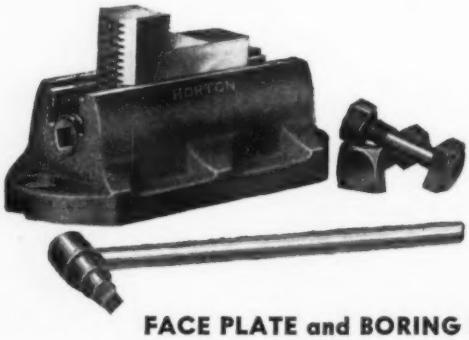
SCROLL UNIVERSAL Two-Piece Jaws Only

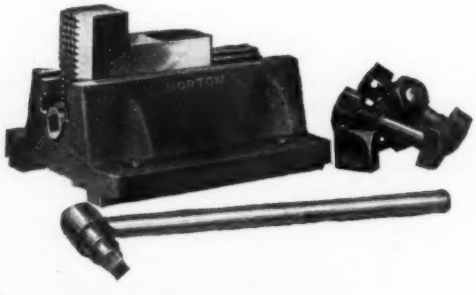
For Use With Intermediate Plates On Threaded Spindles

For Key Drive Tapered Nose Spindles

War Production Limited To These Essential Chucks

For Flanged Tapered Nose Spindles
Illustration shows Chuck for Type D (Cam Lock) Spindle





FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON MORROW

SINCE 1851 .... THE E. HORTON & SON CO.

WINDSOR LOCKS, CONNECTICUT, U. S. A.

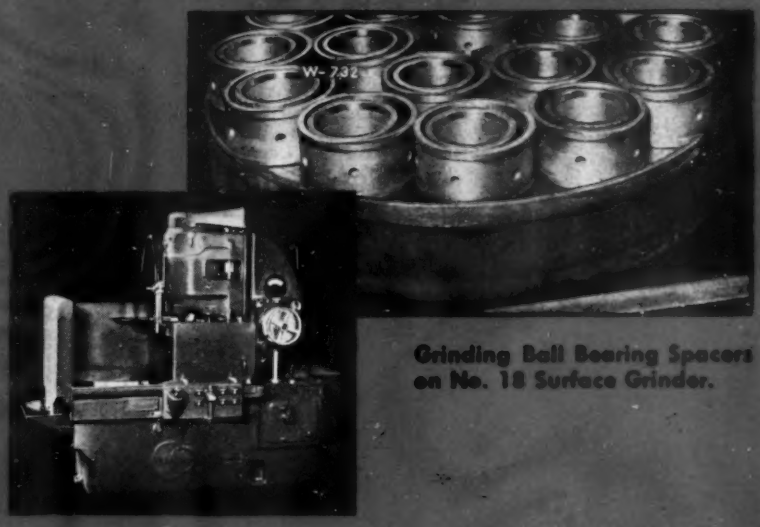
"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- ★ **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Fine Finish**
- ★ **Flatness**
- ★ **Close Limits**

★ . . . . . ***Especially valuable on jobs like the one illustrated.***



Grinding Ball Bearing Spacers on No. 18 Surface Grinder.

EIGHTEEN large cast iron ball bearing spacers, with 18 smaller spacers inside of them, are placed on the magnetic chuck of this Blanchard No. 18 Surface Grinder. The pieces are held against the outer chuck ring and against each other. Two square blocks laid in the center of the chuck fill the gaps in the inner row.

.025″ of stock is removed from each side of these cast iron spacers to limits of .0002″. 36 large and 36 small pieces (144 surfaces) are ground per hour.

This job was previously done on a small surface grinder, taking about 20 minutes per pair. The operator offered this testimonial: "You can say from me that the feed on this machine is the most accurate I have seen."

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

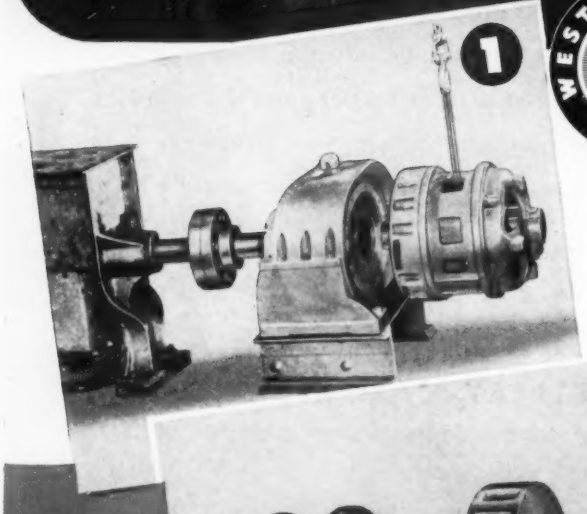
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

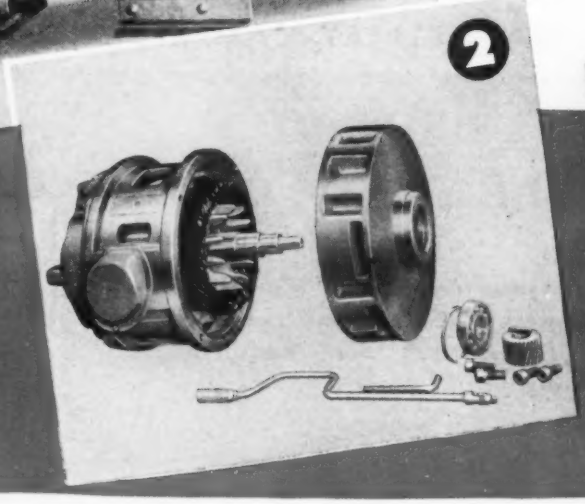
A BETTER ANSWER TO SLOW-SPEED DRIVE PROBLEMS . . .

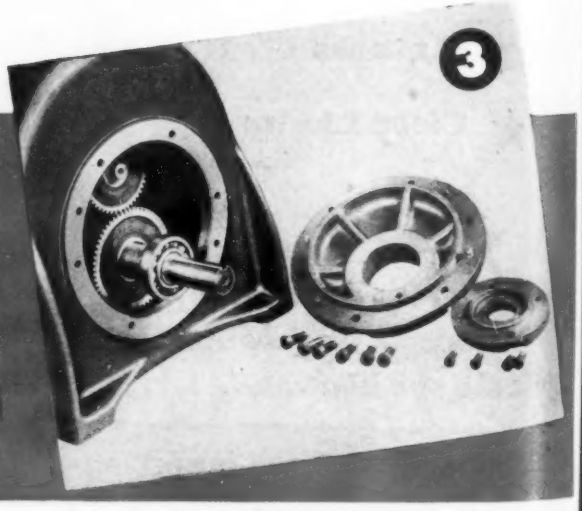
WESTINGHOUSE

HERE'S HOW VITAL PARTS OF THE NEW GEARMOTOR CAN BE REACHED QUICKLY

1. **DETACH THE MOTOR.** Foundations of gearmotor and driven machine need not be disturbed.
2. **INSPECT MOTOR PARTS.** Removing adapter reveals interior of motor for checking insulation, etc.
3. **REMOVE END PLATE** of Single Reduction Gearmotor and gearing parts are ready for inspection.







. . BECAUSE *It's easier to get at*

FOR THE MAINTENANCE MAN, the new Westinghouse Gearmotor is a real time-saver. All working parts are quickly accessible. The photographs on these pages demonstrate how easily gearing and motor parts can be inspected or replaced.

And since the Westinghouse Gearmotor involves fewer moving parts, there are less parts to wear . . . less maintenance to be expected. Many parts are interchangeable between unit types, reducing your replacement stock by as much as forty per cent.

FOR THE PURCHASING AGENT, the job of selecting, ordering and specifying the correct gearmotor is greatly simplified. All Westinghouse Gearmotors meet A.G.M.A. recommended practice, fit every type of load condition and service.

FOR THE PLANT ENGINEER, streamlined compactness saves production space, because new gearmotors can be fitted tightly against the driven machine. To meet postwar conversion needs, standard Westinghouse motor types are interchangeable on the new gearmotor; it can be moved easily to new locations.

FOR YOU, Westinghouse has prepared a 20-page data book on "GEARMOTOR APPLICATIONS." Ask your Westinghouse representative for your copy. Or write today to Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-07211

The New **Westinghouse**

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

GEARMOTOR

4. **UNBOLT END CAP** of the Double Reduction Gearmotor, to inspect bearings. Next . . .

5. **LIFT OFF COVER.** Case is split horizontally at shaft centers for complete accessibility. Finally . . .

6. **LOOSEN INNER BEARING BRACKET.** Gear assemblies can now be inspected, removed or replaced.

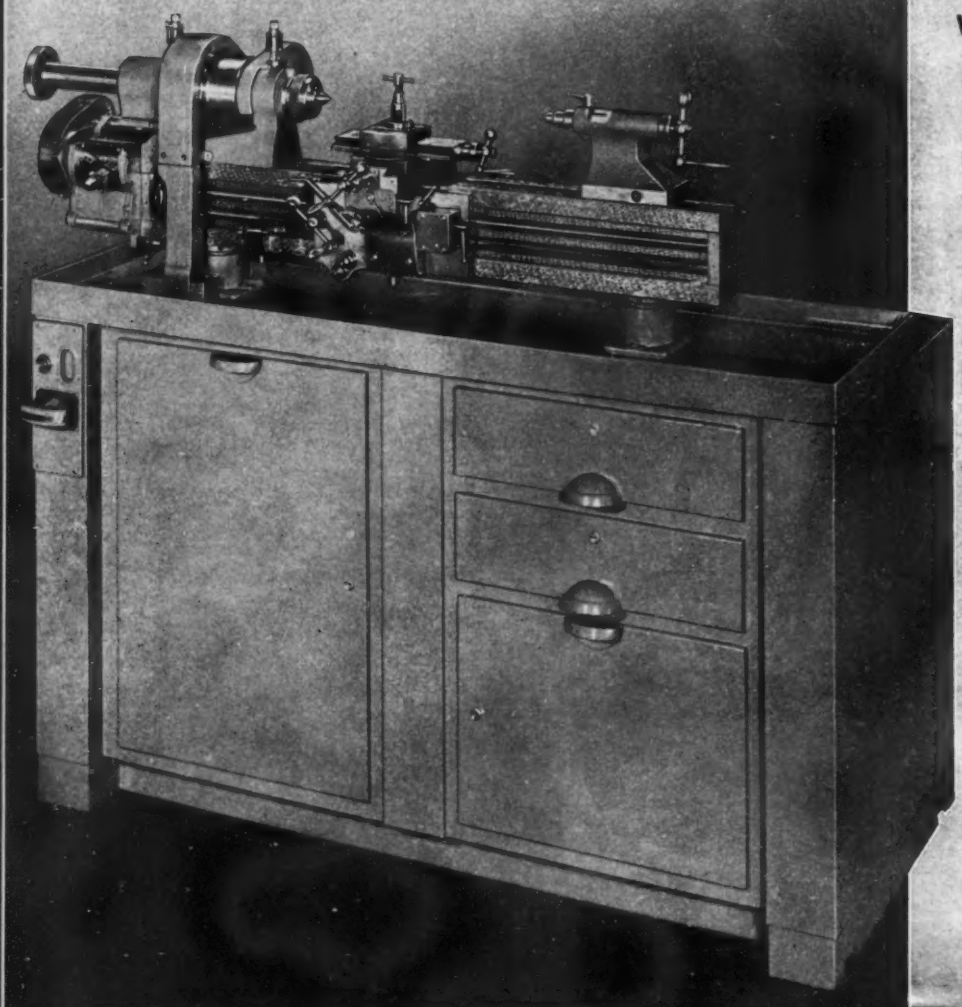
RIVETT

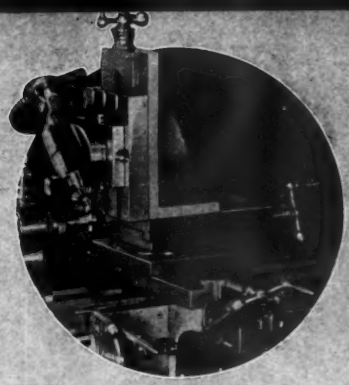
608 WITH VEE BELT DRIVE

In Tool-Making and Instrument Shops It Will Handle Great Variety of Jobs in Minimum Time

The Rivett No. 608 is a super-precision, back-geared screw-cutting bench lathe designed for fine manufacturing, repair and experimental work. In tool-making and instrument shops it will handle a great variety [illegible] the closest precision limits.

Finely made attachments for [illegible] slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations enable [illegible] fully equipped No. 608 to finish his work completely without recourse to other machines, and throughout his entire series of operations to utilize the inherent precision of the lathe itself.





Milling

Multiple Operations

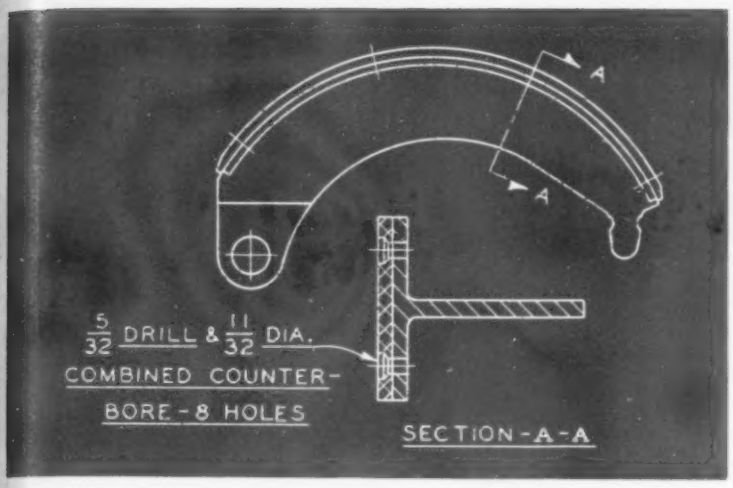
SPECIFICATIONS

With Flat or Vee Belt Drive

Swing over bed, dia.	8½"
Length of bed	40"
Distance between centers	18¼"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of top slide	5¼"
Slide rest, travel of cross slide	4½"
Feed range, through gear box	.0015" to .0220"
Thread range, through gear box	10 to 144
Tailstock spindle travel	3¼"
Spindle speeds:	
Flat belt drive—12 speeds	39 to 1295 r.p.m.
Vee belt drive—12 speeds	25 to 1500 r.p.m.
Weight of lathe, mounting and drive:	
Flat belt drive, net	900 lbs.
Vee belt drive, net	1050 lbs.

For Further Description Write for Bulletin 608

RIVETT LATHE & GRINDER INC.

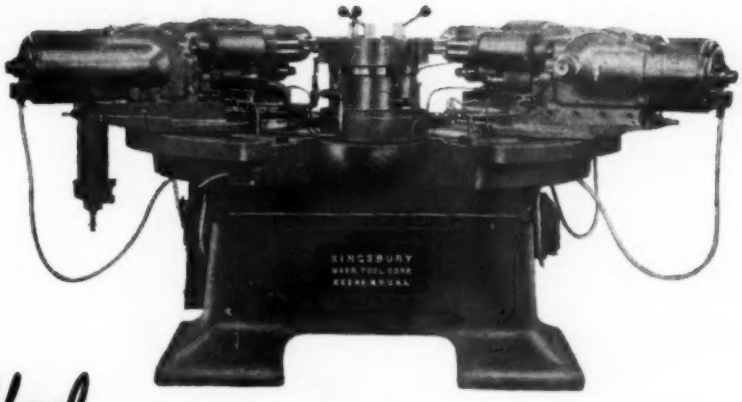


THIS IS A

FLEXIMATIC

AUTOMOTIVE JOB!

Brake Shoe and Lining Production Speedily and Accurately Handled



FLEXIMATIC

by KINGSBURY

One important advantage of the FLEXIMATIC is the fact that it is a machine providing automatic indexing for performing various machining operations in a single chucking of the work.

This method is specifically applied to the Model GD Eight-Spindle Fleximatic arranged for drilling and counterboring brake shoes and linings shown in the accompanying drawing. Many variations of the machine are available, some for lining only and others for shoes only.

The FLEXIMATIC system pioneered by Kingsbury, involves a single base on which is mounted an indexing turret and standard metal cutting units for each operation such as drilling, reaming, counterboring, etc. The turret is designed to receive a number of duplicate work holding fixtures and can be rotated intermittently under control of the operator for presenting fixtures to loading and working stations. While units are in action, the turret is locked securely. All automatic operations are performed simultaneously while the operator removes a finished part and replaces it with a rough part at the loading station.

Speed, accuracy and easy handling even by unskilled operators are inherent in the performance of FLEXIMATICS.

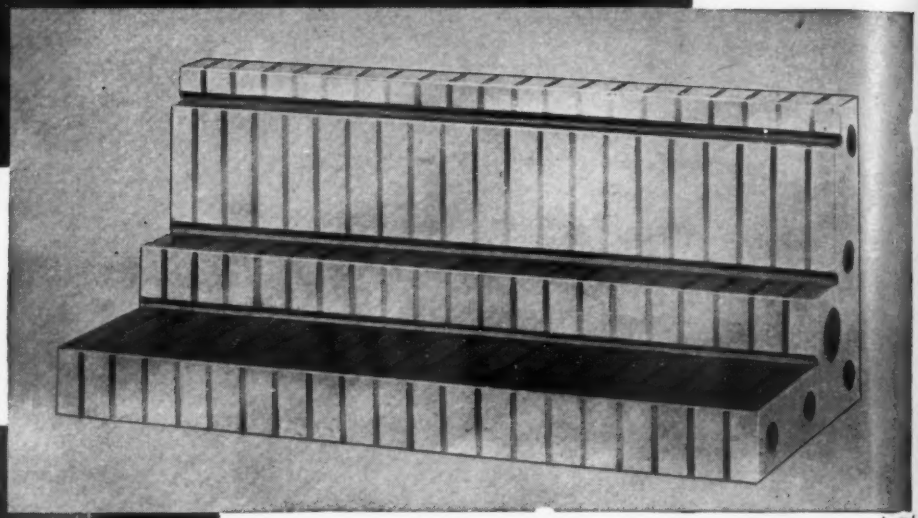
Write today for illustrated Bulletin showing a number of different set-ups

KINGSBURY MACHINE TOOL CORPORATION

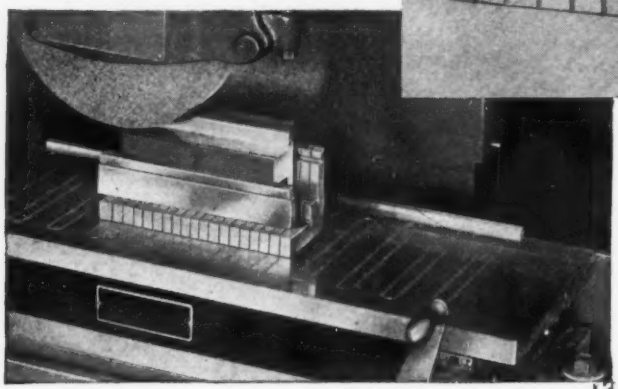
KEENE NEW HAMPSHIRE U S A

SPEED SET-UP *and* GET MAXIMUM UTILITY
FROM MAGNETIC CHUCKS *with* . . . . . .

MAGNE-BLOX ANGLE IRON



Grinding measuring table square and flat by using the Universal MAGNE-BLOX ANGLE IRON. Because the Angle Iron is square, work may be ground exactly square—a feature which is not possible where work is placed on the chuck itself.



As an accessory for the magnetic chuck this useful grinding room specialty provides the means for holding practically any type set-up for toolroom or production operations.

MAGNE-BLOX ANGLE IRON consists of a series of steps upon which may be placed a wide variety of special pieces without the use of complicated clamps and attachments. By placing it on your magnetic chuck you have a magnetic right angle giving you the same holding power per square inch as the chuck itself. Steps measure 3/16", ¼", ½", ¾", 1-5/16" and 1¾" in width; overall dimensions are 3" x 3" x 7½".

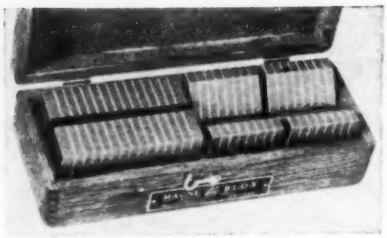
MAGNE-BLOX ANGLE IRON makes it possible to grind straight edge sections without using clamps. The piece to be ground is merely placed against angle iron and the current turned on. In addition, small, difficult to clamp pieces, thin pieces and sides of square pieces are typical uses for this device. With the use of a sine bar or bevel protractor, work requiring grinding at various angles may be laid out and handled. For whatever purpose Magne-Blox Angle Iron is employed, hours can be saved on grinding operations with work securely and accurately held.

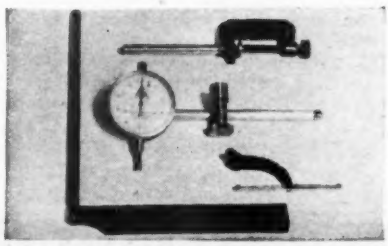
Single MAGNE-BLOX Angle Iron in hardwood case—$40.50

Matched Pairs MAGNE-BLOX Angle Iron in hardwood case—$81.00

Write for full information on SCHERR GRINDING ROOM SPECIALTIES.

SCHERR MACHINISTS' TOOL SPECIALTIES





"LITTLE WONDER" RADIUS DRESSER will dress convex or concave radii from 0 to 1" without removing wheel guard.
Price $46.00 with Diamond

•

MAGNE-BLOX laminated magnetic parallels and V blocks—for holding work that cannot be placed directly on magnetic chuck.
Price $14.50

•

REED MICROMETERS are easily read, sensitive and long-lived. Lead accuracy is assured over the full range of screw.
Model Shown $9.23

•

DIAL INDICATORS—fully guaranteed for accuracy, attachments available which extend range of uses.
Complete Set $18.00

•

ALSO: Machinists' Tool Chests and Machinists' Tools. Full details on request.

GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

UNION

Maintain accuracy with fewer production delays! Every tool in the Union line incorporates features of design and construction based on our continuous research into tooth design, the cutting properties of tool steels, the characteristics of the newest metals and alloys and all other factors affecting efficiency in metal-working. The results of Union research are readily apparent in the longer lasting accuracy of every Union Tool . . . in the maximum production obtained from every machine that is Union-equipped.

UNION TWIST DRILL CO., ATHOL, MASS.

UNION TWIST DRILL CO.
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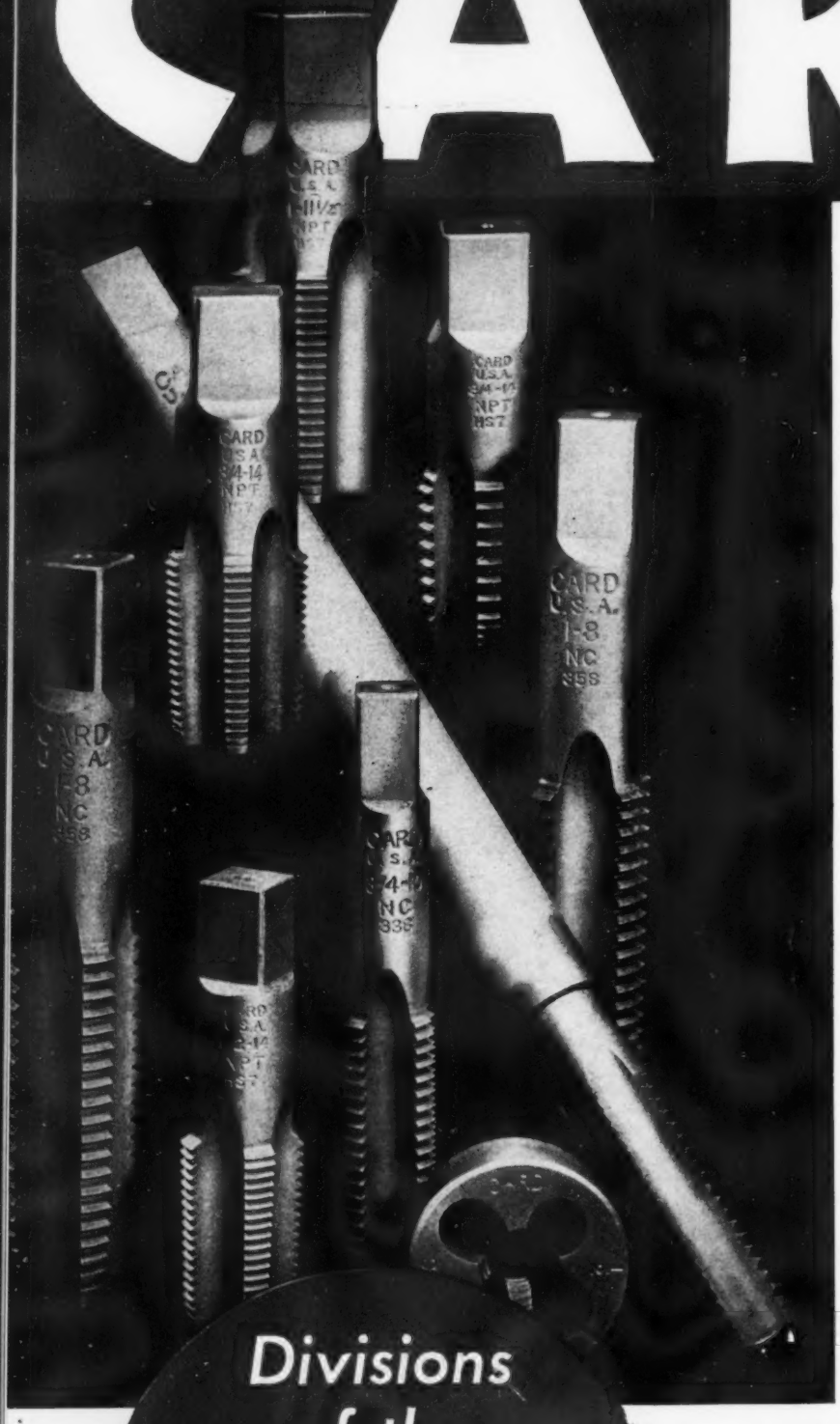
UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

CARD



Meets Today's Challenge of Production

No need to tell you that present production demands require the best in service and accuracy from every tool.

To get highest quality results from Card Taps, take advantage of Card Service . . . We will analyze your threading jobs from every angle and recommend the best procedure and the proper tap for every job.

Quality Taps plus Complete Service — a combination that goes a long way towards meeting today's challenge of production!

Divisions of the
UNION TWIST DRILL CO.

S. W. CARD MFG. CO.
MANSFIELD, MASS.

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UNION BUTTERFIELD CAR

Butterfield

For Tool-Economy and Time-Savings!

Now, when tool-economy and time-economy are equally important, you can count on Butterfield! Shops that select Butterfield Taps and Reamers as standard equipment know from experience that these tools combine, in perfect proportion, the qualities that result in tool-savings and time-savings on every job. You need not sacrifice time to save tools, or burn up tools to meet production deadlines. Choose Butterfield and get both!

BUTTERFIELD DIVISION
DERBY LINE, VT. **ROCK ISLAND, QUE.**

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UNION BUTTERFIELD CARD

FAR EASIER OPERATOR TRAINING

—experience of a hundred users of the DEVLIEG JIGMIL

Experience of more than a hundred users of the DeVlieg Jigmil has proved that operator training is far easier with this machine—because the Jigmil has built in features of quality that do not require a compromise with operator skill to produce accurate work in high production.

Every frequently used function of the machine is controlled in the master switch on the spindle head—at the operator's fingertips. These include:

Spindle start, stop and reverse.

Power vertical feed and rapid traverse movement.

Power horizontal feed and rapid traverse movement.

Power automatic table retraction and repositioning.

Power feed and rapid traverse to bar movement.

The operator never has to take his eyes off the work—never has to look at controls during operation. The machine is so convenient it gives greatly simplified response to the operator's skill.

An operator learns rapidly—frequently reaches full production of high quality in a week or two.

NEW TYPE MACHINE

Spacing accuracy of a jig borer . . . performance qualities of a milling machine . . . convenience and flexibility of a horizontal boring mill.

New speed of operation—many machines show 75% greater average daily productivity.

Write for Circular

DE VLIEG MACHINE COMPANY

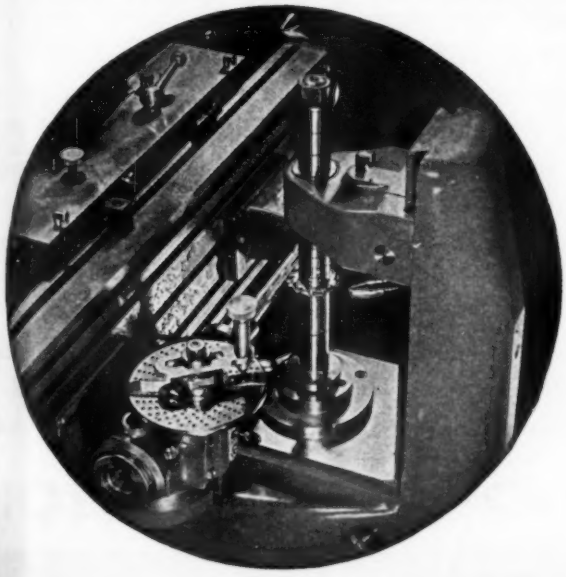
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

DEVLIEG MACHINE TOOLS

DOUGLAS PRECISION MILLER

for Toolroom and Production

THE PRECISION BUILT INTO THE DOUGLAS MILLER



provides efficiency and speed to produce small parts requiring the extreme accuracy essential for war production.

Simplified design and rigid construction as well as central control make for easy operation and permit the release of highly skilled labor for other tasks.

A wide selection of speeds meets all requirements for toolroom and production.

There is an ample variety of feeds from which to choose the right feed for material and accuracy requirements.

Timken bearings and helical drive gears are other features to assure a smooth performance. Write today for specifications and prices.

PROMPT DELIVERY TO WAR PLANTS

DOUGLAS MACHINERY CO., Inc.

150 BROADWAY NEW YORK, N. Y.

"PICK ANY P

"No trouble now getting accuracy . . . and hig
we're using EX-CELL-O Pr

To get best use of your present Ex-Cell-O precision boring equipment, you should have the Ex-Cell-O Instruction Book. If you do not have it, write for free copy. State style of Ex-Cell-O machine you are using.

ENGINEERED for flexible use, Ex-Cell-O Precision Boring Machines are aiding numerous war manufacturers, in large and small plants, to speed up output, to keep down costs, and to improve the quality of the metal parts they produce. Today, thousands of these Ex-Cell-O precision machines are definitely proving themselves, not only in the actual quality and speed of the work they perform but in all those other important factors that reflect soundness in designing and thoroughness in building: *Flexible,* so that they may be applied to varied types of operations; *easy to operate,* so that new workers may be quickly trained to use them, and employee fatigue minimized; *precision performing,* so that rejects will be few and far between; *substantial in structure* and *simple in maintenance,* so that "time out" for repairs and other non-productive attention will be practically nil. All of these qualities are engineered into every Ex-Cell-O Precision Boring Machine.

EX-CELL-O CORPORATION •

PRECISION THREAD GRINDING, BORING AND LAPPING MACH
GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS
EQUIPMENT • PURE-PAK CONTAINER MACHINES RAILR

PIECE . . . CHECK IT"

high production . . . on all these parts . . . Precision Boring Machines!"

XLO
EX-CELL-O for PRECISION

Features that make for extreme flexibility on Ex-Cell-O precision boring machines

STANDARD UNIT CONSTRUCTION—nine machine styles, five bridge types, eleven spindle units, and two hydraulic systems. Fixture designed to suit your parts.

SPINDLES CAN BE MOUNTED AT ANY ANGLE to the line of table travel—for taper boring or taper turning.

FROM ONE TO FOUR SPINDLES can be mounted on a bridge—wide range of spindle center distances.

BRIDGES CAN BE ADJUSTED ENDWISE on the machine base rails—to reduce lost time and motion in table travel.

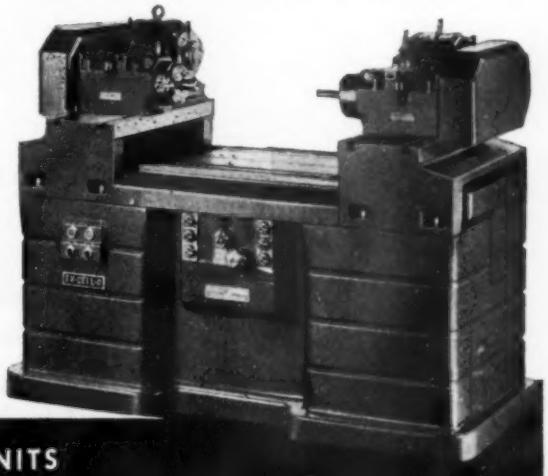
TABLE OPERATION IS HYDRAULIC IN BOTH DIRECTIONS on all machines—for boring in, or for boring out deep or blind holes.

WIDE RANGE OF MATERIALS—cast iron, steel, aluminum, babbitt, bronze, etc.—can be bored, turned, and faced.

ON ONE MACHINE you can handle wide variety of parts, sizes and operations, with quickly and easily interchangeable fixtures.

EX-CELL-O STANDARD UNIVERSAL FIXTURE enables you to handle small or experimental lots, or, with a sub-fixture, medium production.

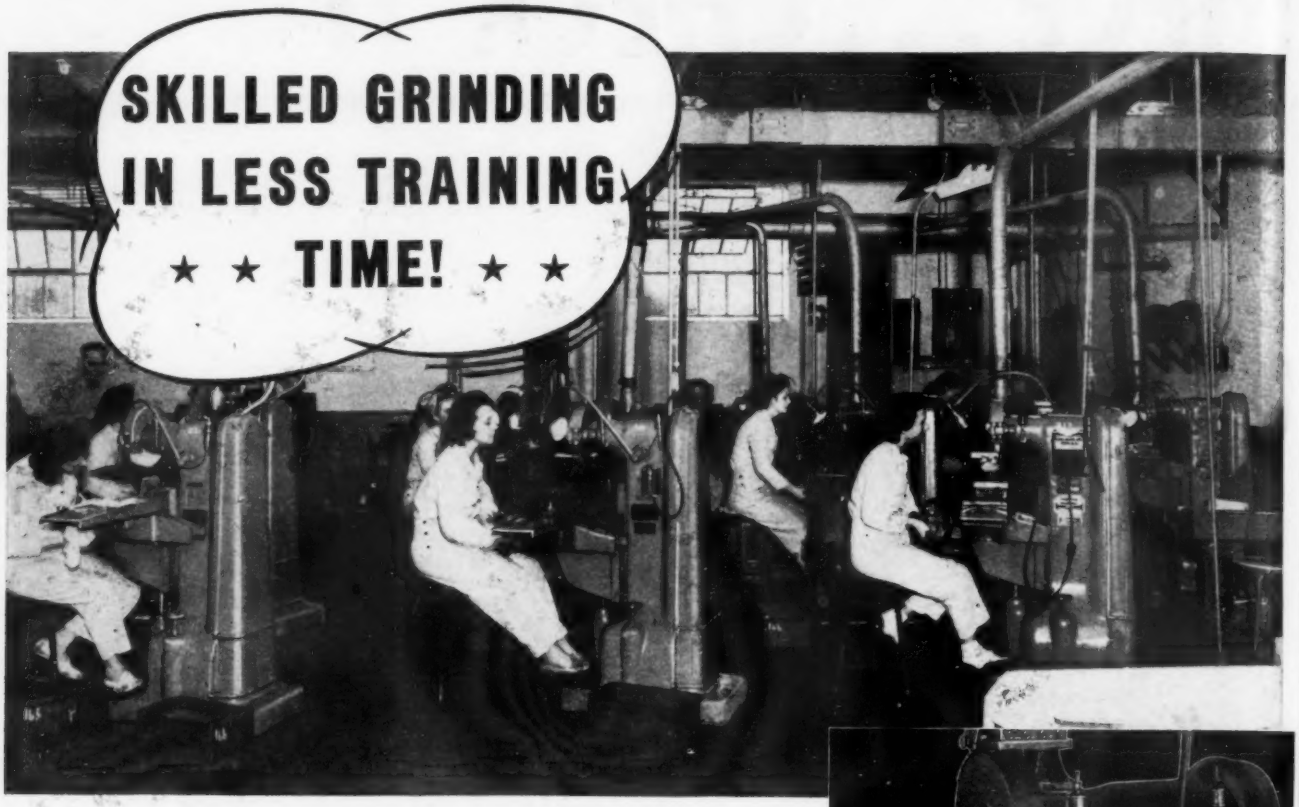
Below: Ex-Cell-O Double-End Senior Precision Boring Machine—one of nine styles of Ex-Cell-O machines for turning, facing, and boring with speed and accuracy. (Style 215-A shown).



DETROIT, MICHIGAN

PING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS
TING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION
INES RAILROAD PINS AND BUSHINGS • PRECISION PARTS

COVEL GRINDERS SPEED PRODUCTION . . . CUT COSTS



Because THE COVEL NUMBER "15" IS SIMPLE—SAFE—ACCURATE—FAST

Scores of plants, faced with the tough problem of se curing high grinding production while breaking in "green" operators, have found a solution in Covel's No. 15 Hand Feed Surface Grinder. "Quick Set-Up," safety-for-the-work, conveniently located controls and accuracy plus speed enable unskilled workers to quickly raise their output without sacrifice of quality. The many outstanding features of this famous high-production grinder are fully described in Covel's Bulletin A-113—write, wire or phone today for your copy and name of nearest dealer.

CAPACITY 6" x 18"

SAFETY-FOR-THE-WORK

No. 15's fixed spindle construction eliminates the possibility of the grinding wheel damaging the work by accidentally dropping into it. The work moves UP to the wheel—an important safety feature, since most jobs are 90% finished when they reach the surface grinder.

PROMPT DELIVERY TO WAR INDUSTRIES

Shorten Employee Training Time With Covel Equipment

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

"SO WE'VE GONE SOFT, HAVE WE?"

"Axis leaders say it's so...because we make electricity do our hard work. That's a laugh! But, let 'em go on thinking it. They'll learn the cold, hard facts soon enough."

You can say *that* again, Jim!

We'll take our exercise the pleasant way. But when it comes to getting heavy loads from here to there, we'll let George Kilowatt do it! That's the fast, easy, low-cost way.

For over half a century we've been proving just that. And we've been doing some *im*proving, too! For example, this five-step, variable speed control for P&H Hevi-Lift Hoists gives you the change of pace to meet every requirement for speed in lifting, lowering, or travel. And you do it just by pressing buttons.

General Offices: 4514 West National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION

HOISTS · WELDING ELECTRODES · MOTORS · P&H · EXCAVATORS · ELECTRIC CRANES · ARC WELDERS

P&H HEVI-LIFT HOISTS

Offered in all capacities up to 15 tons with a wide variety of mountings. Standard equipment includes full magnetic push-button control. Write for literature.

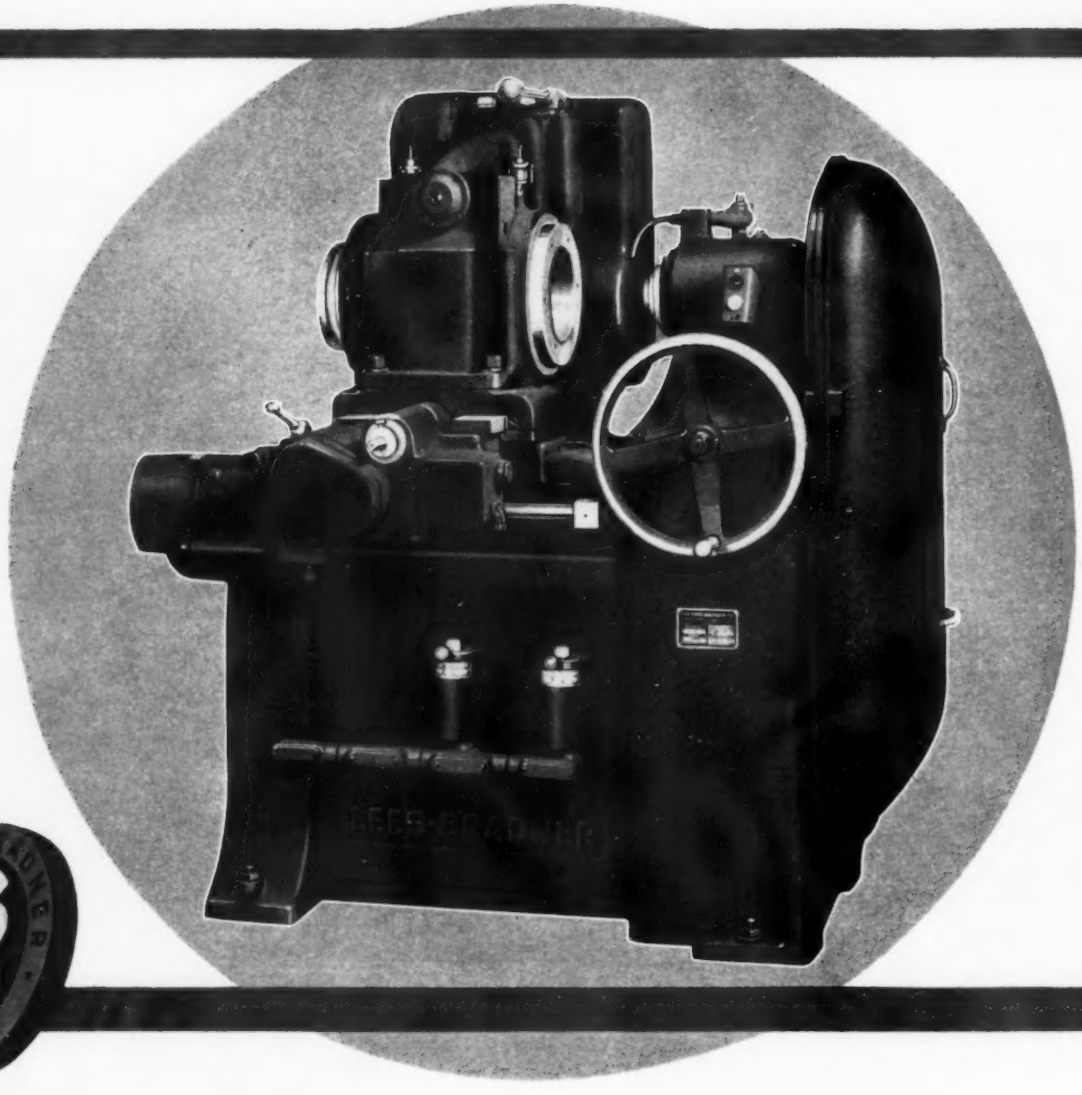
★

ARMY E NAVY

A new star has been added to P&H's award for excellence in war production.

LEES-BRADNER

Production Thread Miller



● Simplicity and extreme ruggedness, characteristic features of the design and construction of this modern machine, enables users to put unskilled labor on these tools knowing that they can expect the generation of precision threads with the minimum of instruction required.

Why not investigate the high output—precision—and the exceptional finish this high production tool will yield?

Contact the Lees-Bradner Engineer for specific information on your precision thread requirements.

The LEES-BRADNER *Company*

CLEVELAND, OHIO, U.S.A.

VAN NORMAN HIGH FREQUENCY INDUCTION HEATING

Section of tube brazed by Van Normanizing. Heating time—6 seconds.

In the illustration, collars are brazed to tubes in 6 seconds with Van Norman High Frequency Induction Heating. Bonds are clean, tight and uniform. The finished part has no discoloration and is free from scale, thus cleaning operations, which are usually necessary when torches and other brazing methods are used, are eliminated, spoilage is minimized, and piece after piece is brazed with the same uniform results. Obviously, VAN NORMANIZING produces a better finished part, speeds output and reduces costs.

By using the proper work-holding fixture and heating coil, a number of workpieces can be brazed simultaneously. Odd-shaped parts are just as easily brazed by Van Norman High Frequency Induction Heating as uniform parts.

It will pay you to investigate Van Norman High Frequency Induction Heating for Hardening, Brazing, Soldering, Annealing and other applications requiring localized heat.

"It pays to Van Normanize"

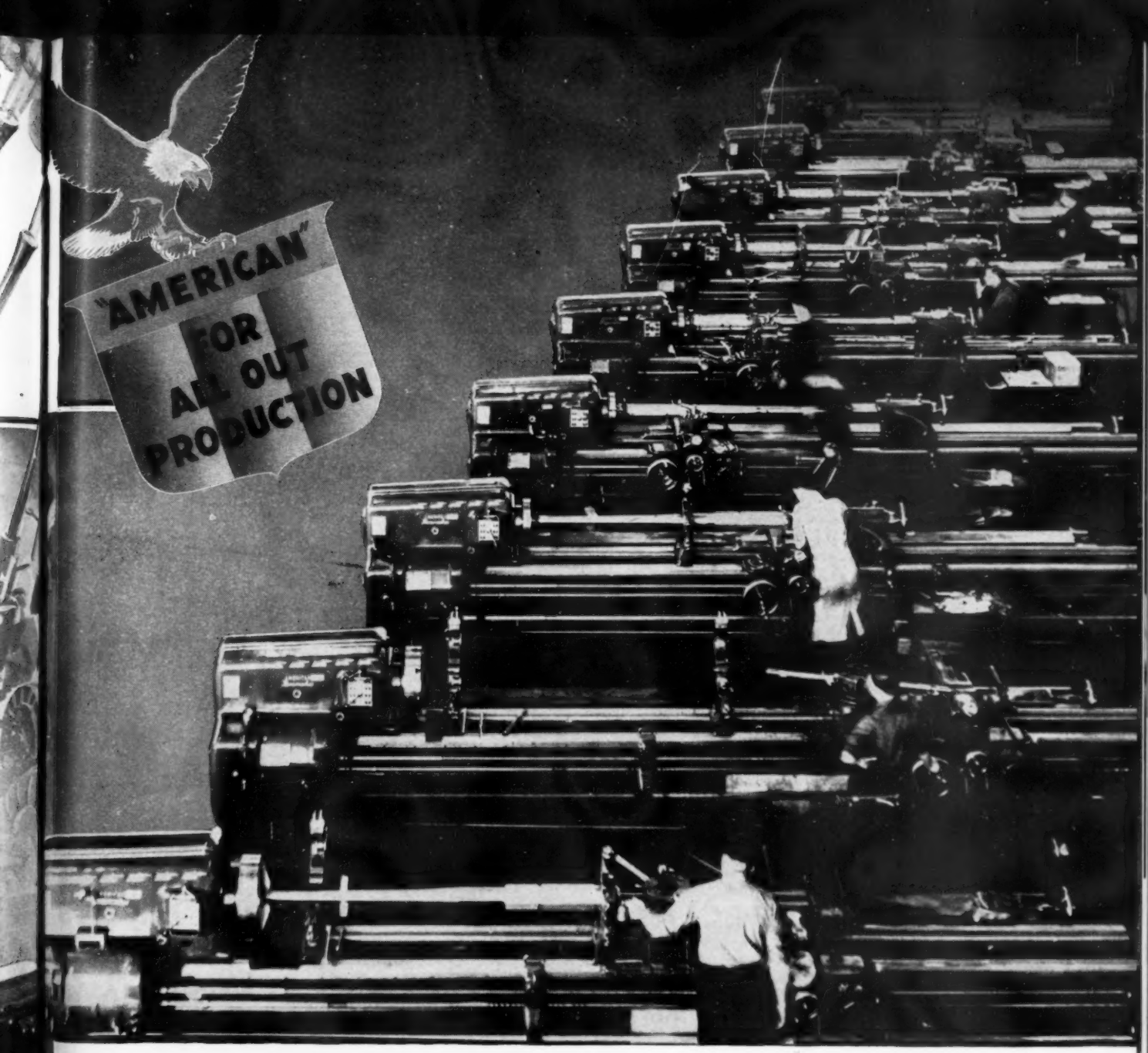
ARMY E NAVY

VAN NORMAN MACHINE TOOL CO.

SPRINGFIELD, MASSACHUSETTS

Guns by the Thousands!!

and Row upon Row of "AMERICAN" PACEMAKER LATHES



...producing them in the Plant of THE DOMINION ENGINEERING CO.

Our fighting forces need guns and more guns and they are getting them in ever increasing numbers.

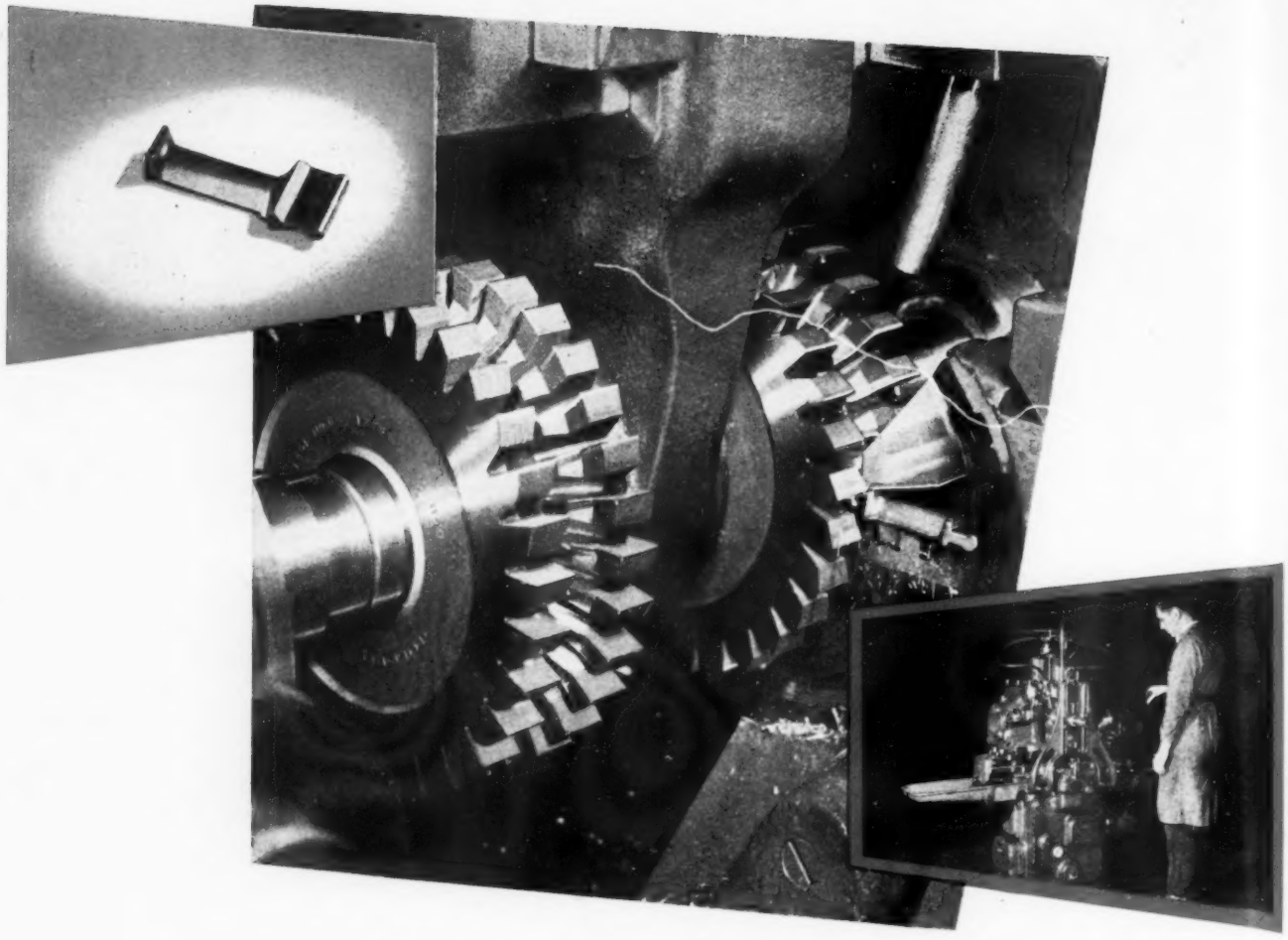
In the gun plants of this country and Canada "AMERICAN" Lathes are meeting every challenge of increased schedules. They are producing as they never produced before and at the same time are maintaining amazing standards of accuracy.

For all-out production, call on "AMERICAN".

THE AMERICAN TOOL WORKS COMPANY

Lathes - Radials - Shapers

CINCINNATI, OHIO, U. S. A.



with B-C *Accurate Sizing . . . to .0003"* SPECIAL STEPPED STRADDLE MILLS

THIS important piece in a vital war machine is finished in three milling operations from a tough steel forging. The first operation, which consists of straddle milling the sides of the piece, is shown in the photographs above. A two-position reciprocating table is used on the milling machine so that one position is cutting while the other is being emptied and reloaded. Two sets of cutters on the arbor are used, as shown. The cut is parallel most of the way and flares at a precise angle on the step. The width, and the position of the step, must be held within +.0003" −.0000". The Barber-Colman Milling Cutters used in this operation were *specially designed for the job* by experienced B-C small tool engineers, based on requirements of extremely fine finish and close tolerances. Their outstanding performance is full testimony of our engineering department's ability to design Better Cutters. You, too, can profit from this engineering service by taking your cutter problems to your Barber - Colman representative nearest you, or by sending the data directly to us.

PRODUCTION DATA

Material — Tough Steel, Work Hardens.
Feed — 5⅛" per minute.
Cutter Speed — 70 R.P.M.
Stock Removal — Width ⅛", Depth 1¾".
Machine — Sundstrand No. 1 Rigidmil. Special table.
Holding Means — Special Fixtures.
Production — 120 pieces per hour, increase of 84%.
Pieces per Cutter Sharpening — 2000.
Production with former method — 65 per hour.

CUTTTING TOOLS ARE SCARCE
MACHINES CAN'T RUN WITHOUT THEM
CONSERVE WHAT YOU HAVE

Buy War Bonds

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 201 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

Deep Drawn Bomber Parts are Turned out Quickly at the FORD Willow Run Plant on

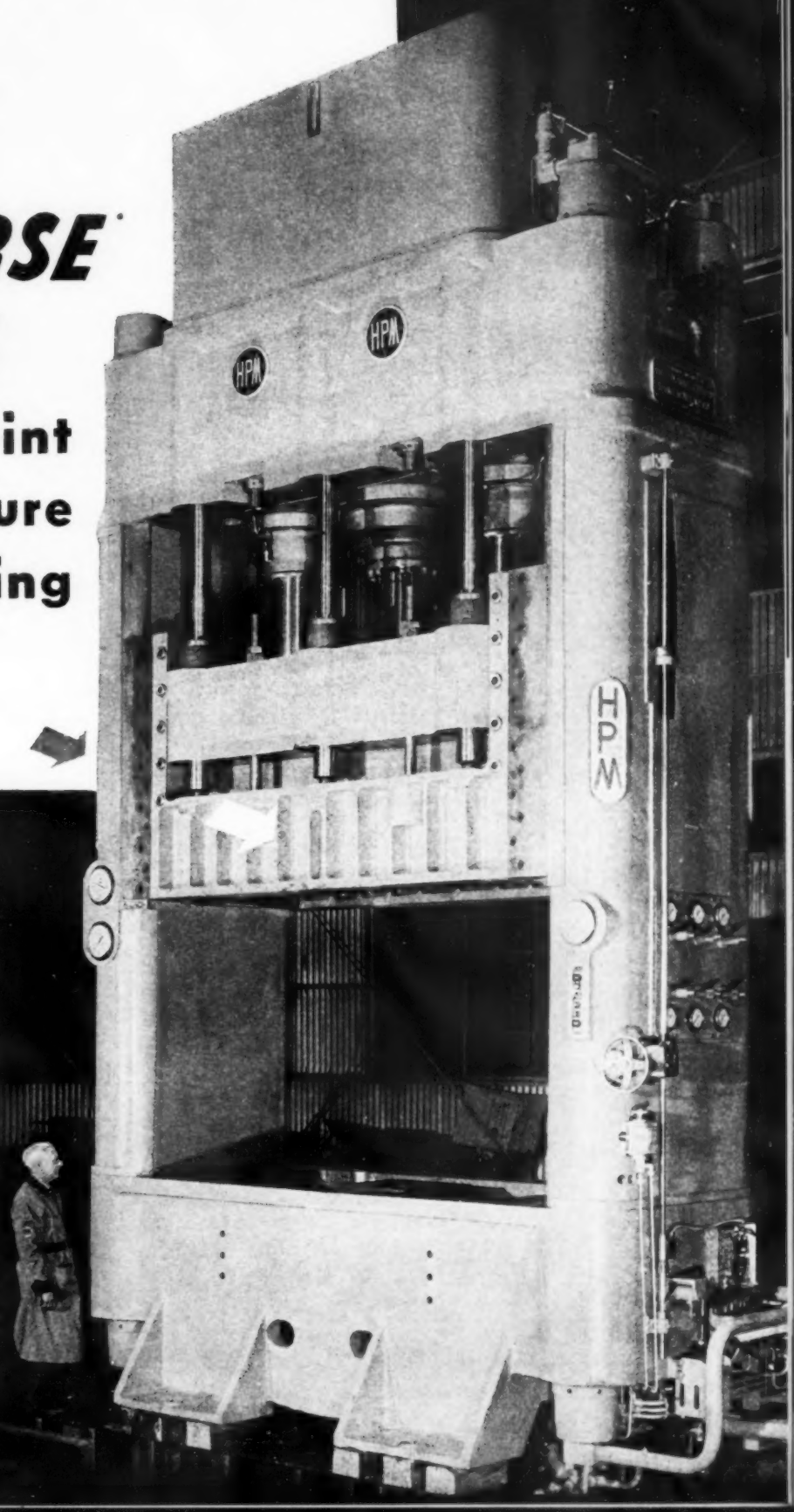
HPM

FASTRAVERSE PRESSES

with New 6 Point Variable Pressure Blankholder Ring

	Main Slide	Blankholder Slide	Die Cushion Platen
Pressing Member			
Pressure Capacity (tons-net)	750	300	175
Pressing Surfaces (L-R x F-B)	105" x38"	120" x60"	20" x40"
Daylight Openings (Max.) Main Slide to Bed	114"	----	----
Blankholder Slide to Bed	----	96"	----
Ram Travel (Max.)	42"	27"	10"

The dependable long life HPM HYDRO-POWER Radial Pump powers every HPM Hydraulic Press.



Employing the HPM Closed Circuit system of shockless operation, these large HPM Fastraverse Blankholder Presses with variable 6 point pressure ram resistance on the periphery of the blankholder ring are especially adaptable to the deep drawing of large aircraft parts. The pressure of each of the six blankholder rams can be adjusted individually and independently. Separate hydraulic die cushion fitted into the press bed can also be used as an ejector, when desired. The two slides locked together give single action service increasing the maximum pressure capacity to 1000 tons. Investigate this versatile press for both present and future deep drawing requirements. » » »

THE HYDRAULIC PRESS MFG. COMPANY
Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities.

This Mazlo Magnesium permanent-mold casting is an airplane starter-motor housing, one of many thousands made by American Magnesium Corporation. Magnesium contributes the lightness and high strength so necessary in aircraft; "Know-how" contributes the soundness and accuracy of detail that simplify and speed manufacturing.

Where parts are required in sufficient quantities, permanent-mold castings offer these advantages over sand castings: Surfaces are smoother and grain structures finer. Dimensional tolerances are closer, so castings can be lighter and need less machining. Costs of finished parts are usually less.

After the war, there will be a wealth of capacity to take care of your permanent-mold casting requirements—many times that of prewar industry.

Magnesium alloys have casting characteristics peculiar to themselves, in addition to low specific gravity. This means that the methods of gating, chilling and coring, and how the metal is handled, all affect the quality of castings. That's where our experience can serve you best.

Twenty years of working with magnesium alloys have taught us *how*. American Magnesium engineers and plant men offer you that guidance. Sales Agent for Mazlo Magnesium Products: Aluminum Company of America, 1709 Gulf Building, Pittsburgh, Pa.

MAGNESIUM MAZLO PRODUCTS

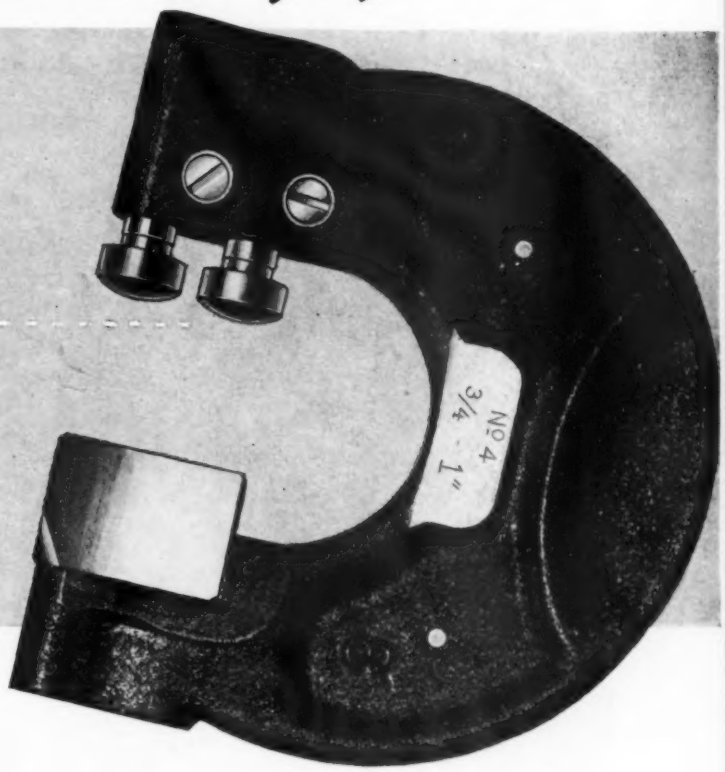
REG. U.S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

STANDARD
SUPER *Snap Gage*

With
SPHERICAL
Gaging Pins
that involve no condition of parallelism . . . .
YET PROVIDE *greater* ACCURACY IN PRECISION INSPECTION



A new contact principle . . . . simple and practical*

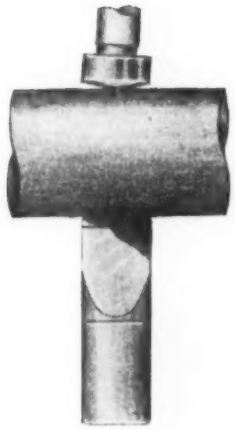
As mass production is accelerated, the need for faster, simpler, and *greater accuracy* of inspection becomes imperative. Snap gages are commonly used to control finer tolerances, but strain on the locking device distorts the frame thereby rendering the gage inaccurate. This distortion tilts the flat surfaced pins a few .0001" throwing them out-of-parallel to the common anvil, an important factor when tolerances are measured in .0001".

The STANDARD Super Snap Gage with its SPHERICAL gaging pins eliminates out-of-parallelism. This new spherical-contact principle involves no condition of sustained parallelism. The SUPER Snap Gage is easily set, requiring no simultaneous adjustment to a given dimension and to parallelism. It simplifies inspection, assures greater accuracy, and speeds production and inspection.

The return of out-of-parallel snap gages for correction is eliminated. Only pins and anvils need be held in reserve, instead of complete gages. The initial cost of the SUPER Snap Gage is no more. Pins are available as separate parts, to fit existing American Gage Design models.

(Pat. Pending)*

Conventional Snap Gage with flat surfaced gaging pins. The tilt is exaggerated to make the diagram clear. Note that only at their edges do the gaging surfaces contact the piece being gaged.



This illustration shows the Super Snap Gage with the pin shank at the same angle as in the diagram at the left. Note that the contact conditions are exactly the same as if the pin were not tilted.

Send for Illustrated Folder

STANDARD GAGE CO., Inc.
Poughkeepsie, N.Y.

•
IMMEDIATE DELIVERY from stock
•

This illustration shows a Super Snap Gage mounted in a bench stand for convenience in checking.

MASTER CRAFTSMEN MANUFACTURING precision GAGES AND INSTRUMENTS

"GOOD SWEEPIN' SAILOR!"

You with the big brooms—you PC men. You and your GI cans, sweeping the subs clear to hell and gone.

When we say we're with you, sailor, there's no scuttle-butt about it. We speak the same language, although we can't say too much out loud.

★ We can say this, though—the diesel motor that skims your PC over the swells, through the troughs, under the storms and gales — we built it, we'll bet you! And we build 'em to carry you through. Some of our boys, sailor, are your shipmates.

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

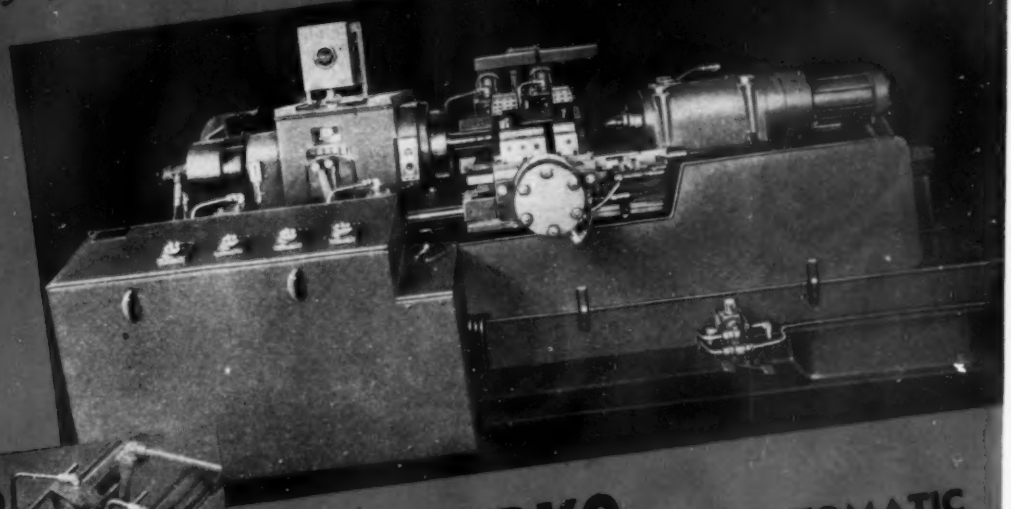
THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

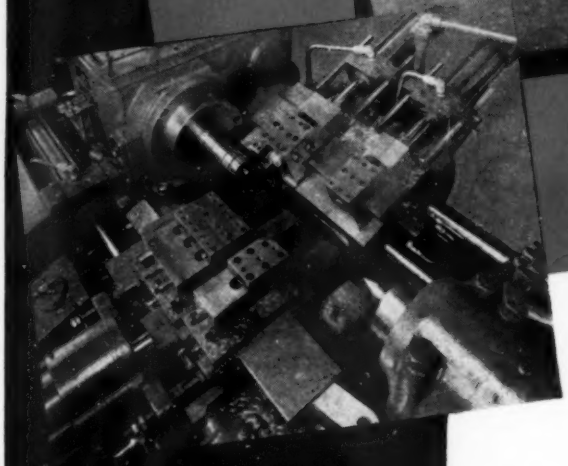
GENERAL MACHINERY ORDNANCE CORPORATION

6" ARMOR PIERCING NAVAL SHELL

finish turned on a mass production basis



ON SPARKS SEMI-AUTOMATIC HYDRA-FEED MANUFACTURING LATHE



Ability to provide multiple-tool set ups, the intricate movements of which are powered and controlled hydraulically, enables the Sparks lathe to handle a wide range of jobs on a mass production basis. In addition, ease of operation, assured accuracy and automatic increase of tool movement speeds are attained during non-cutting, thereby reducing floor-to-floor time.

All these advantages are realized in the set-up shown here for finish turning armor piercing naval shell.

. . . . How this job is handled

Four cam controlled front tools turn the nose contour, body diameter and front and rear bourrelet. Two rear tool blocks are employed, one carrying the base facing tools while the second can be used, if needed, for a trimming tool. Cross slides are provided with individually controlled hydraulic movements.

VERSATILE TOOLING FOR A WIDE RANGE OF WORK

The wide scope of utility of the SPARKS is attained by the variations in tooling set-ups permitted by the general design. Tooling set-ups usually include carriage, cross slide, tool slides, tool blocks and cam. In many cases a very simple change in tooling will permit the handling of an entirely different job. It will pay you to investigate the possibilities of the SPARKS on your work.

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

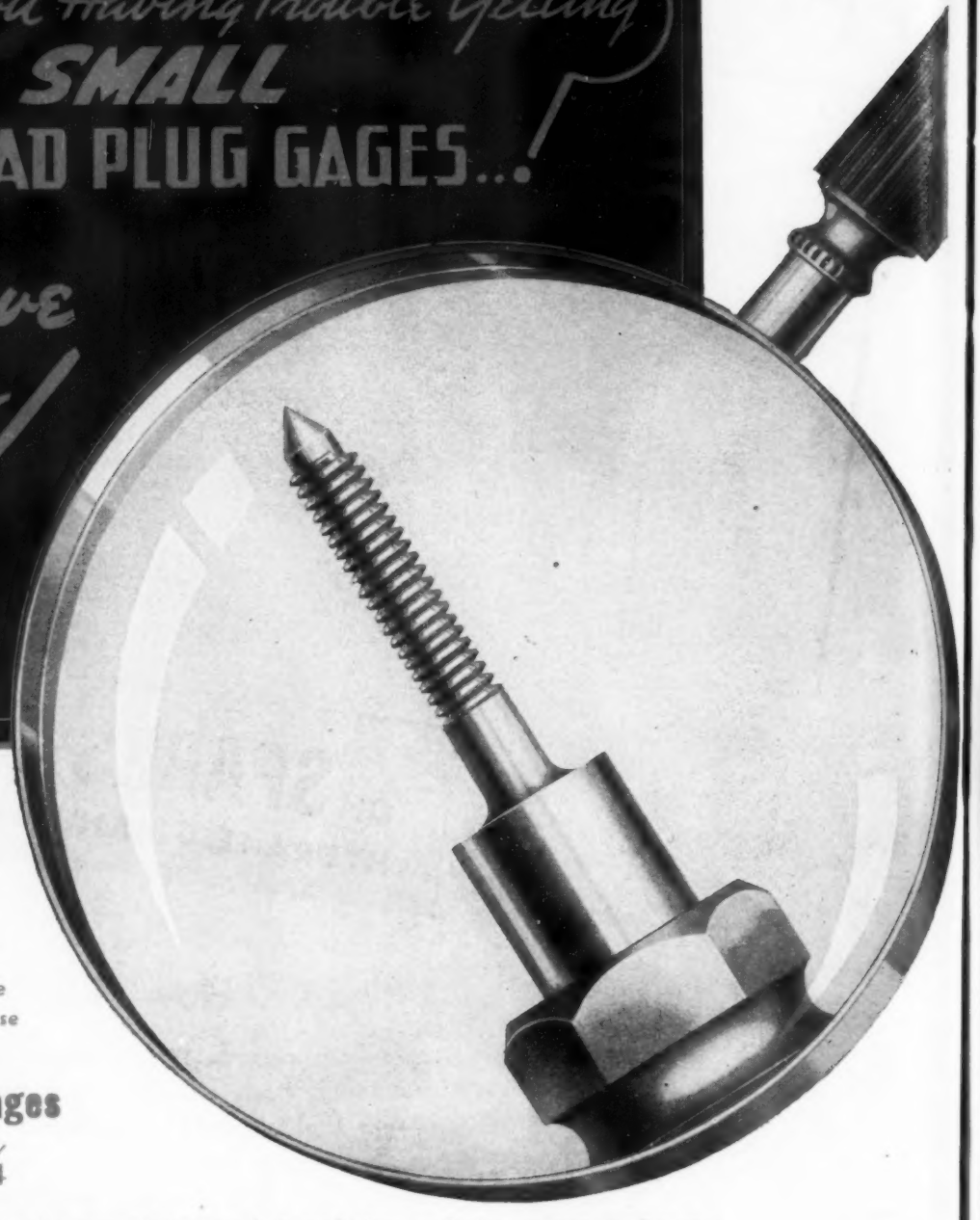
Are You Having Trouble Getting

SMALL

THREAD PLUG GAGES...?

We have them!

Immediate Delivery from STOCK



SIZES

0-80

to 1"-8

National Fine
National Coarse

AND

Pipe Plug Gages

$\frac{1}{8}$ **to** $1\frac{1}{4}$

BY specializing in the manufacture of thread plug and ring gages, to the exclusion of all other types, the Cadillac Gage Company has built up an exceptionally large stock of standard thread plug gages, especially in the machine screw sizes. Orders and re-orders from the nation's leading armament manufacturers testify to the quality and accuracy of our products. Wire us your orders!

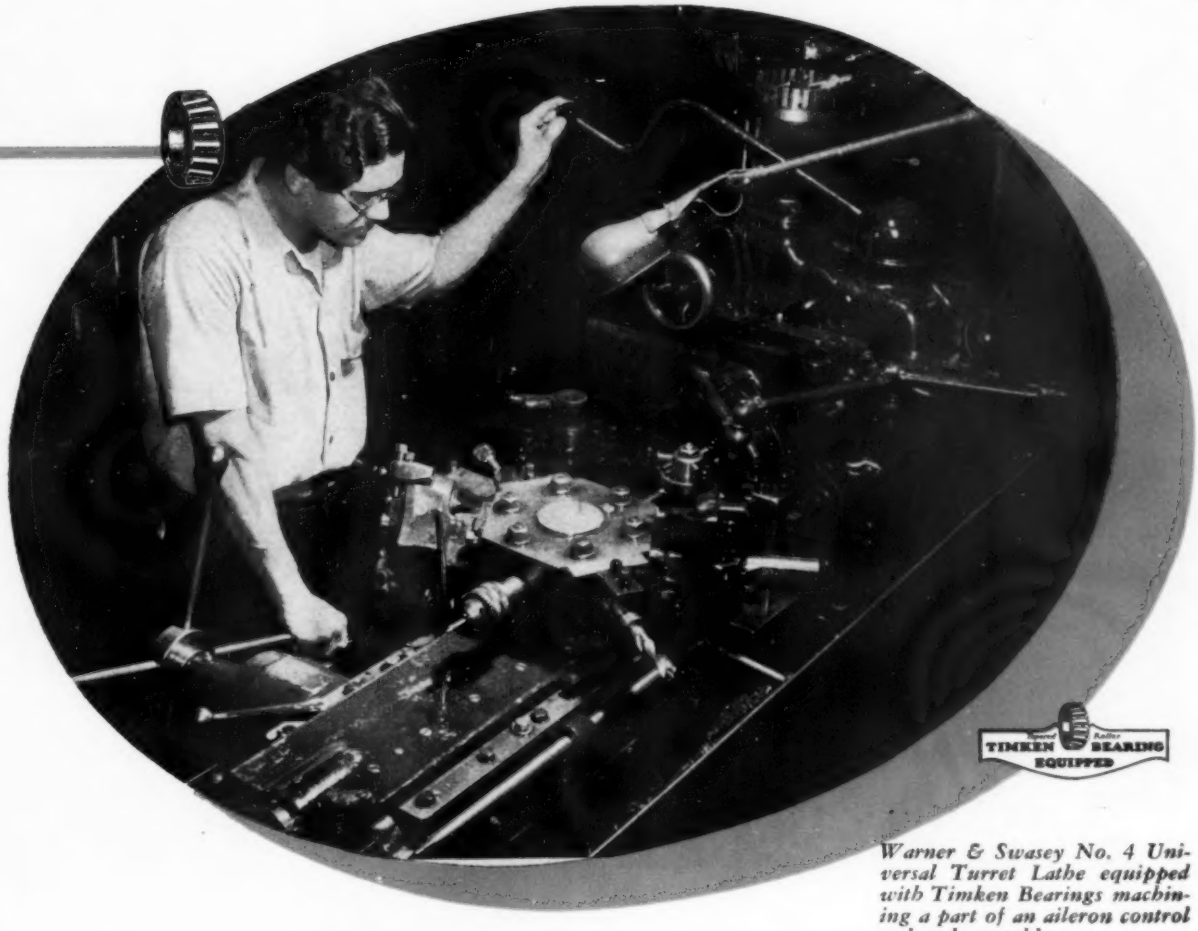
CADILLAC GAGE COMPANY

20316 HOOVER RD. **DETROIT, MICH.**

CADILLAC GAGE COMPANY

DETROIT

Cheating the hell box for Victory



Warner & Swasey No. 4 Universal Turret Lathe equipped with Timken Bearings machining a part of an aileron control rod end assembly.

Wherever machine tools are operated the hell box constantly is yawning for rejected parts, but modern machines equipped with spindles mounted on Timken Tapered Roller Bearings —like this Warner & Swasey Turret Lathe—make the scrap harvest a very meager one.

By helping to keep rejects down to the lowest possible number, Timken Bearing Equipped spindles keep production up. Besides, operating speeds can be faster and less time out is required for lubrication and general maintenance.

In addition to the spindle, many modern heavy duty machines have Timken Bearings at other important points, improving performance still further; these points include all headstock shafts, tailstocks and feed mechanisms. Machines so equipped not only are modern now, but will remain so for many years to come. The Timken Roller Bearing Company, Canton, Ohio.

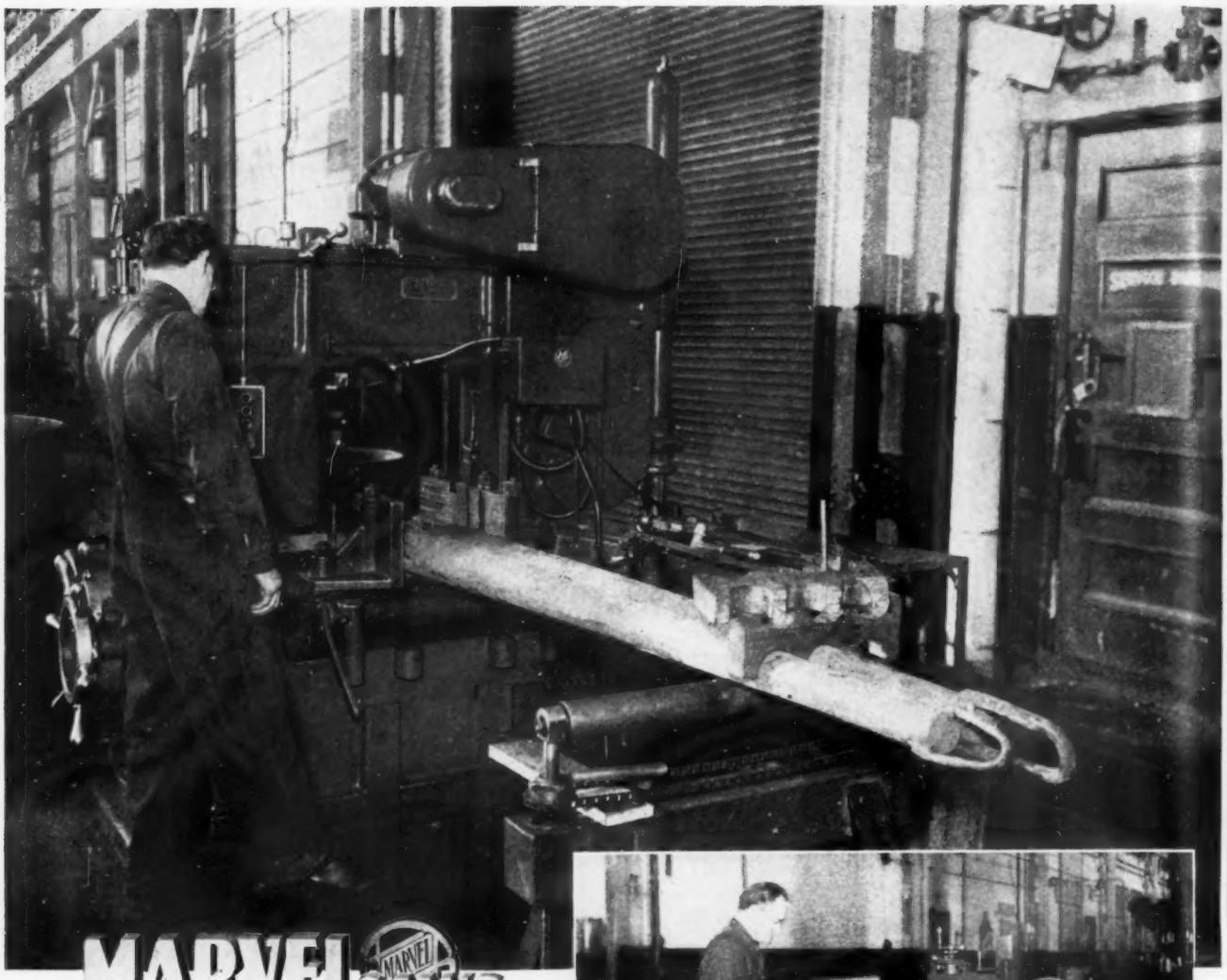
High as performance standards now are in machines of all kinds, they will have to be much higher to assure post-war profits. One way to raise them is use more Timken Bearings. Don't put it off; redesign now.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

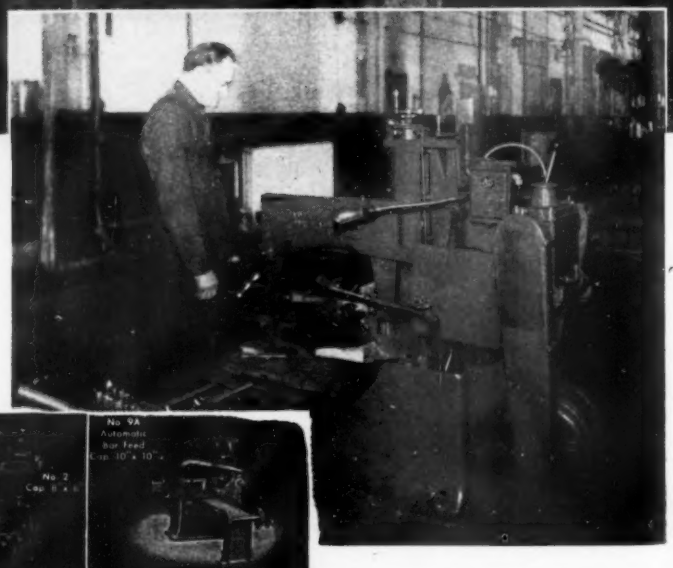
"ALL THERE IS IN BEARINGS"

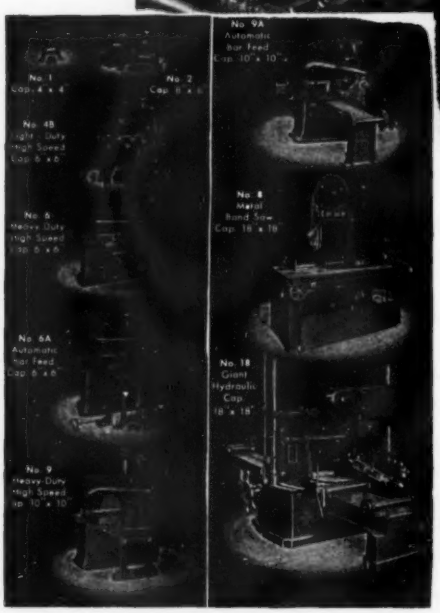


MARVEL SAWS

In the thick of it . . .

In the battle of weapons you will invariably find MARVEL SAWS in the thick of it in private plants, arsenals, armories, airplane plants and ship yards. The MARVEL saws most widely used in armament work are: the No. 18 Giant Hydraulic Saw (above), MARVEL No. 6A and No. 9A High Speed Production Saws equipped with automatic bar push-up, and the universal MARVEL No. 8 metal cutting band saw.





On heavy duty, continuous operation, MARVEL High-Speed-Edge Hack Saw Blades will step-up output by permitting heavier feeds and high speed because they are *positively unbreakable!*

These patented composite hack saw blades (with high speed edge welded to a tough alloy body) will permit any type hack sawing machine to operate continuously at full capacity.

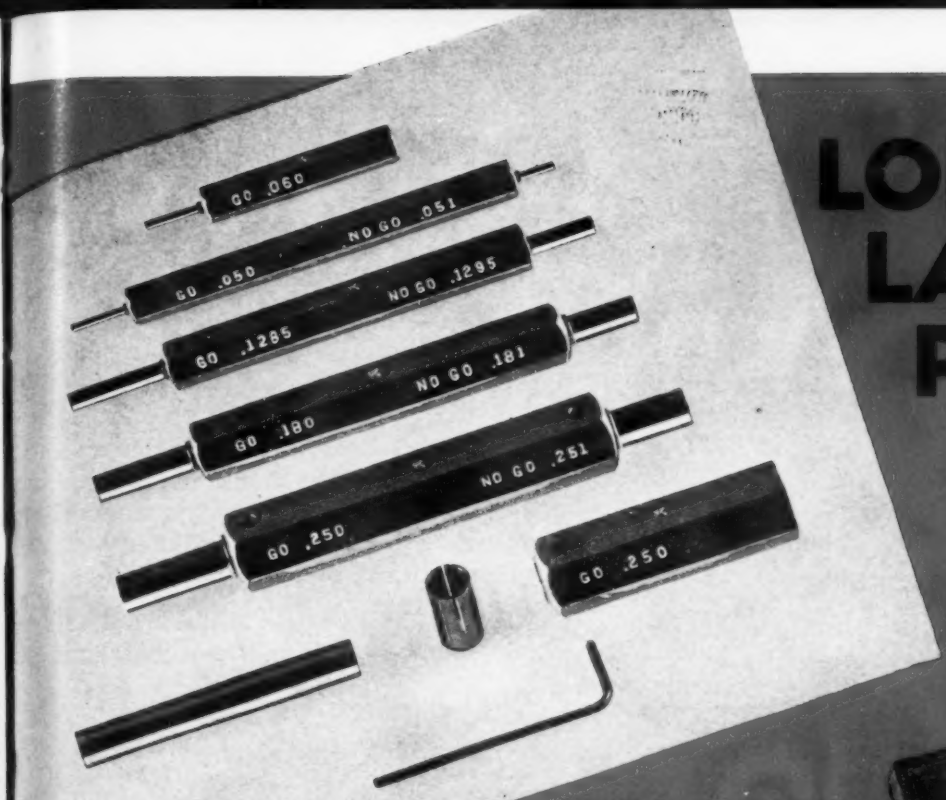
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U. S. A.

Eastern Sales Office:

225 Lafayette St., New York



LONGER LASTING PRECISION

On Small Hole Measurements

WIRE TYPE PLUG GAGE SET No. 40. These gages provide an accurate means of measuring small holes and also standards for checking twist drills in sizes from 1 to 60. (.228" to .040" dia.) PRICE $325.00.

Van Keuren WIRE TYPE PLUG GAGES

Taper insert plug gages in small sizes cost a lot per unit of usable surface. V-K Wire Type Plug Gages give longer lasting precision because the entire 2" length of the gaging unit can be used. Split bushings and headless set screws clamp the wire units securely in the handle. When a unit becomes worn it may be ground off and a new section moved out.

All V-K Wire Type Plug Gages are made to a standard tolerance of +.00005" —.00000" on Go units; ±.000025" on No Go units. Closer or wider tolerances can be supplied if desired.

V-K Wire Type Plug Gages are but one of the many types of measuring equipment in which we specialize. Write for Catalog 31 describing our complete line. More than a catalog! . . . It is a valuable handbook of precision measuring methods.

THE Van Keuren CO., 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages
Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles

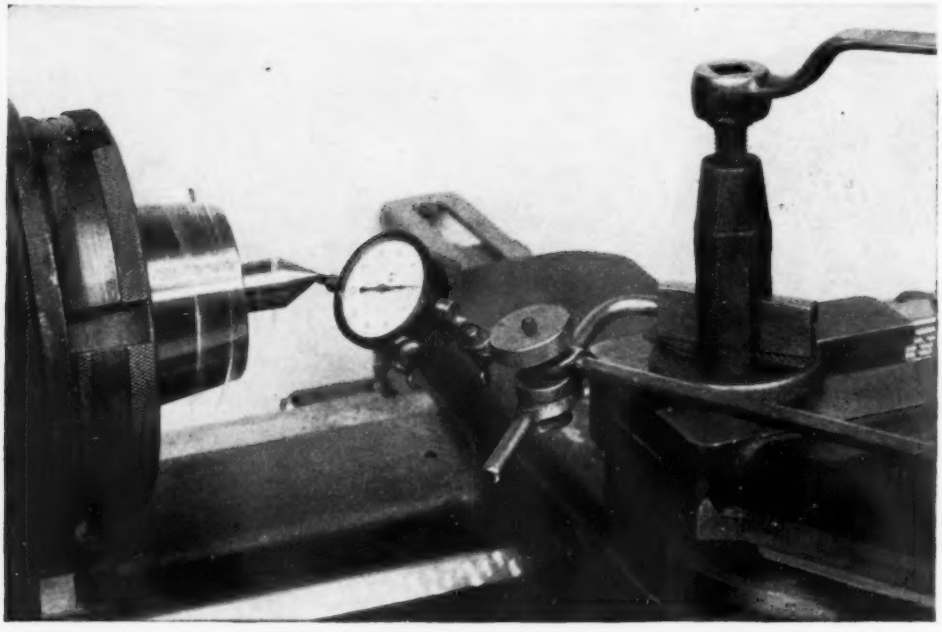
No. 11 in a series of tips on "Keeping 'em Turning" by Arthur Edwards — 41 years at LeBlond.

I'm tellin' you...

"A straight line is the shortest distance between two points." That's the way your lathe spindles should run to turn out a good job — in a straight line. Centers can get out of whack, even the best of them, under continued hard use. We call it "run-out" when the headstock center rotates out of line.

"Run-out" shows up easily if you use a dial type indicator measuring in thousandths of an inch. Here's how to detect and correct it.

Mount the dial indicator on the tool post with the point against the angle of the lathe center. Fluctuation of the needle when the spindle is turning indicates "run-out". Three things may be responsible.



1 — Most likely to be the fault is the presence of dirt or chips in the taper hole between spindle and center bushing or between center bushing and the center itself. Remove the center and center bushing and clean the taper holes in the spindle and center bushing and the outside of both center bushing and center.

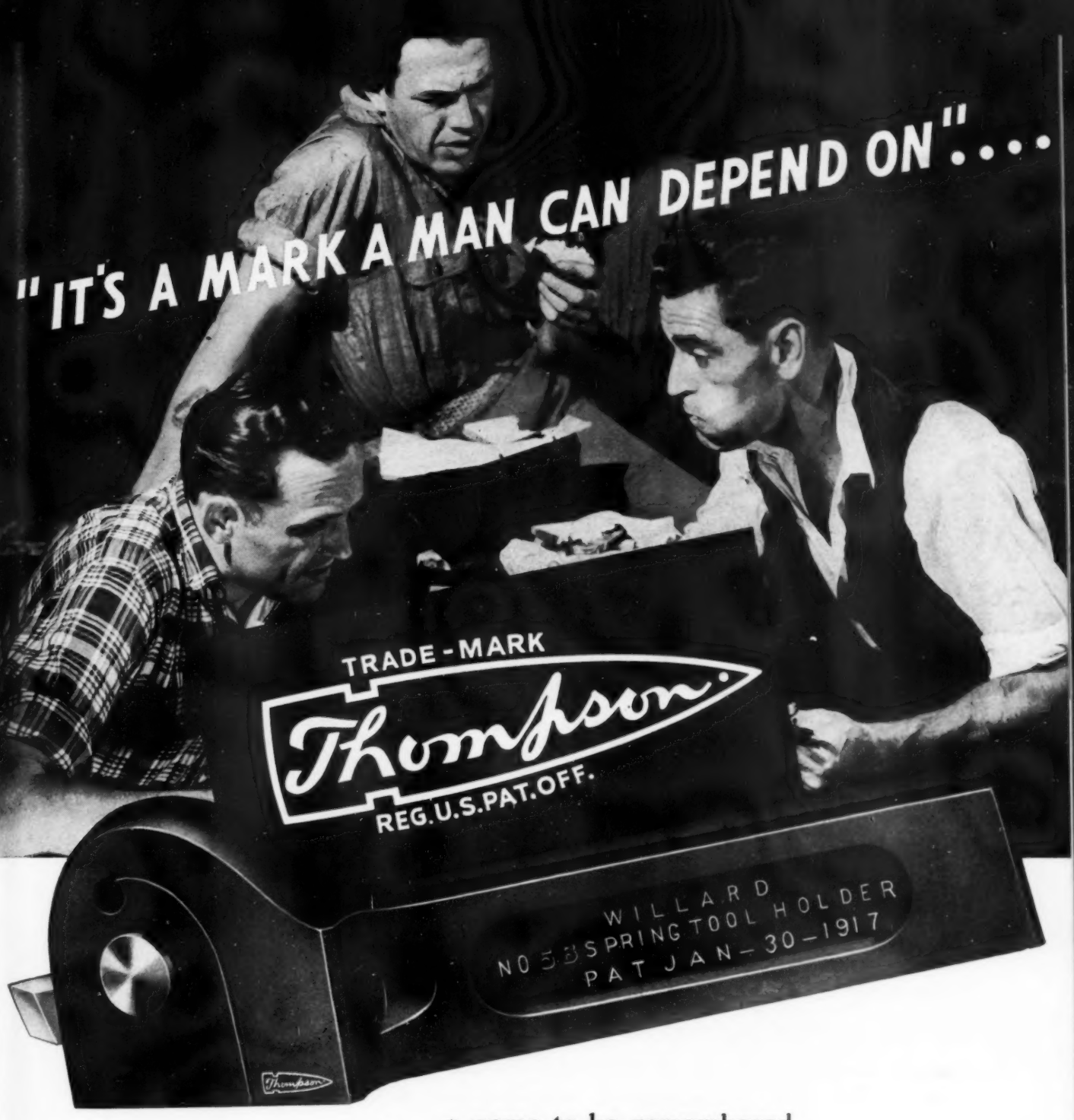
2 — A second source of trouble may be a burr or scratch on the surface of the spindle taper hole or the center bushing. Since the center bushing is hardened, the burr is most likely to be in the spindle hole. In this case, remove the high spot with a scraper or use a Morse taper reamer of appropriate size.

3 — Third cause of "run-out" is inaccuracy of the center point itself. Soft centers can be trued up by setting the compound rest at 30 degrees with the axis of the lathe and taking a skim cut with a sharp tool. Hard centers require grinding. Use a tool post grinder or a LeBlond grinding attachment, mounted at 30 degree angle.

THE R. K. LeBLOND MACHINE TOOL C

CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lath



. . . a name to be remembered.

"THOMPSON" — just a name, but a name to be remembered. To our fighting forces it means "Tommy" Gun — they got them on time, when needed. And our production lines will remember "THOMPSON" — to them it means dependable tools — dependable to work with — dependable because of our ability to produce on time, hundreds, thousands—dependable because the name "THOMPSON" is behind them. On the firing line—on the production line—"THOMPSON" is dependable.

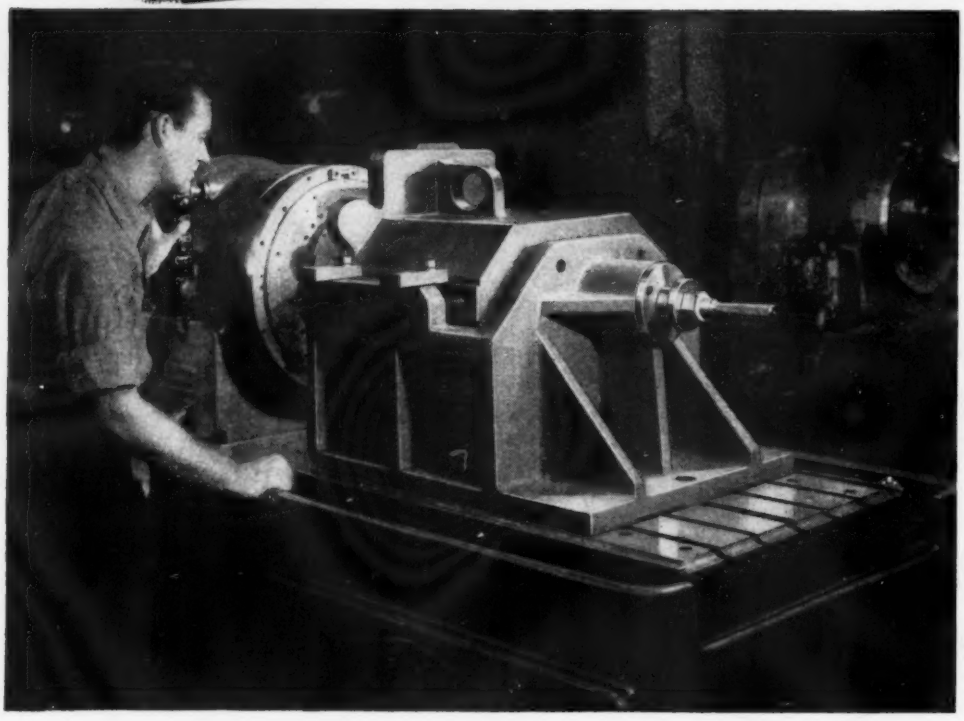
ARMY E NAVY

Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns.

AUTO-ORDNANCE
CORPORATION
Thompson Tool Division

342 WEST PUTNAM AVENUE, GREENWICH, CONNECTICUT

THE PART DOES NOT *Revolve!*



In plan-o-milling, all motion is confined to the milling head. Whether the job be one of external or internal threading, or cylindrical forming, *the part itself does not revolve!* The advantages of this method are obvious.

Large, cumbersome pieces are machined easily and accurately. The heavy, rigid fixture absorbs vibration. Operating the Plan-O-Mill is a simple matter of loading the part and pushing a button.

Plan-O-Mill's automatic feed cycle affords complete control of feed-in and feed-around, for maximum cutter life together with maximum production. If you have not already received your free copies of the two Plan-O-Mill booklets, which clearly explain this remarkably efficient milling principle, write or call your nearest representative.

PLAN-O-MILL CORP., 1511 E. 8-Mile Rd., Hazel Park, Mich.

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WINDSOR, ONT., CANADA
Standard Machinery Tool Co.

MILLING MACHINES
PLAN-O-MILL
MILLING CUTTERS

Lifting the fog FROM THE INDUSTRIAL BATTLEFIELD

Coolant mist from high-speed machine tools takes its toll of men and machines just as surely as a well-placed bomb. By coating light fixtures it reduces valuable footcandles needed for accurate production. By collecting on the ceiling and dripping, it causes operator discomfort, destruction of electrical insulation, and slippery floors that constitute a safety hazard.

Attempts at removal of this mist by mechanical filters are only ten to fifteen per cent effective. Moreover, badly needed and expensive winter heating capacity and summer air cooling capacity are required to replace shop air exhausted.

The practical solution to the problem is a Westinghouse-developed electronic device, the PRECIPITRON*. Oil-mist removal is over ninety per cent effective; room-temperature air is available for re-use. In addition to improvement in operator efficiency, morale, and safety, there is a resultant reduction in electrical failures and in heating and air cooling expense . . . and the reclaimed oil is made available for re-use.

THE MACHINE IN MACHINE TOOLS

Truly, Westinghouse may be said to have put the "machine" in machine tools. George Westinghouse was pioneering the application of alternating current for power at the same time that the empirical designs of early tool builders were first being adapted to machine drives. The growth of the two industries was so interdependent that it would be difficult to trace the history of either one separately. Through the years, that interdependence has come to mean collaboration, in a measure typified by the relationship of Westinghouse engineers with the representatives of the nation's leading machine tool builders. Their ability to provide simple electrical solutions to complex mechanical problems is yours for the asking. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

*Trade-mark Registered in U. S. A.

J-94574

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

PUMPS

FOR EVERY INSTALLATION REQUIREMENT —

For Lubrication—Supplying Coolant—Circulating Purposes—Transfer Work—and for Hydraulic Installations

Rotary Geared Pumps are positive in action and can maintain substantial pressures. Compact Motor Driven types simplify installations.

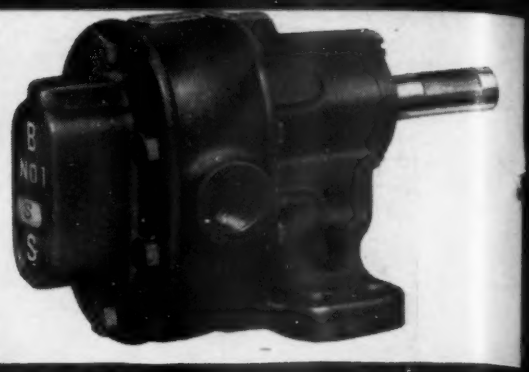
500 Series Rotary Geared Pumps with herringbone gears operate under pressures up to 500 lbs. per sq. in.

Motor Driven Centrifugal Pumps are suited for supplying coolant containing dirt or abrasives and for light transfer work. Pumps having foot type motors or integral flange mountings are extremely flexible in installation possibilities.

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

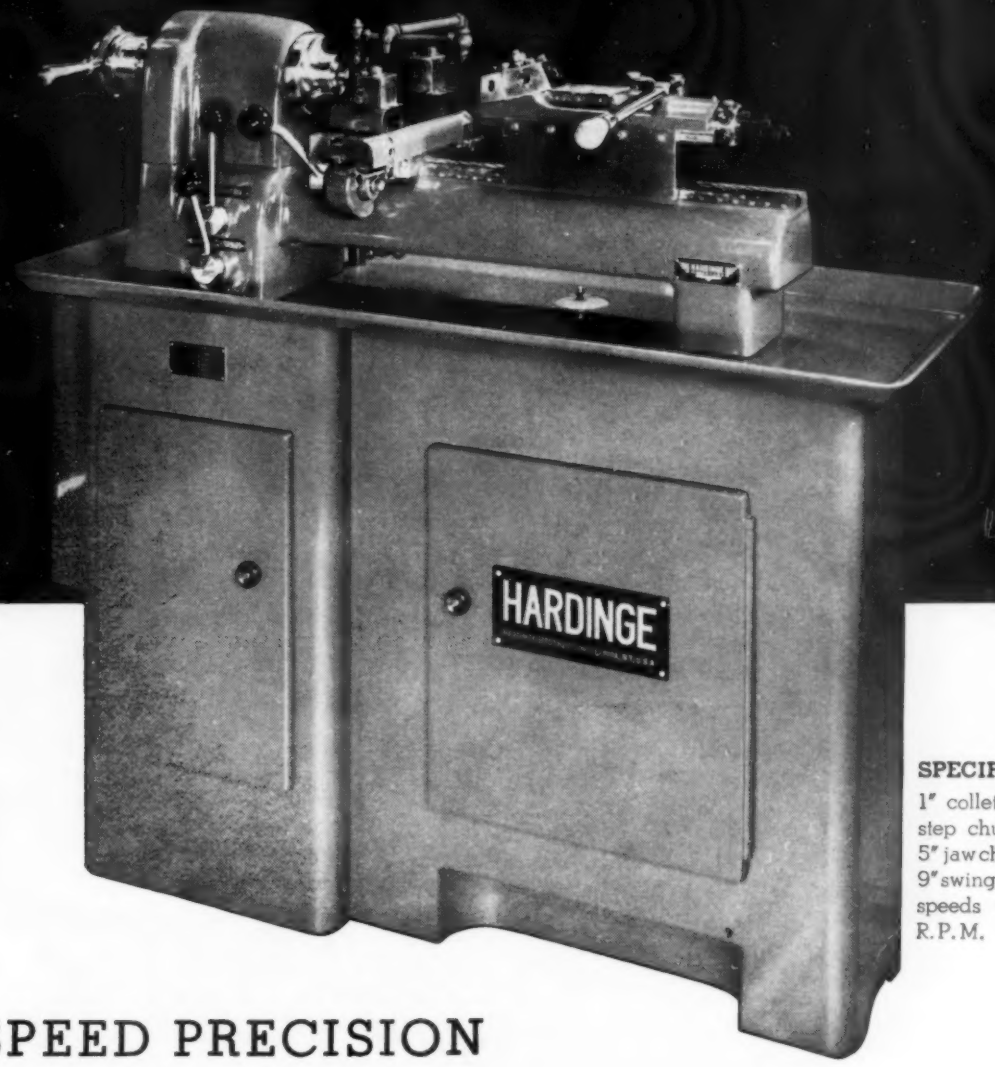
Prompt Deliveries —
on Several Styles and Sizes

Catalog showing complete line of geared, vane and centrifugal pumps including full characteristics, performance charts and engineering data sent on request.



BROWN & SHARPE

HARDINGE



SPECIFICATIONS:
1" collet capacity, 6" step chuck capacity, 5" jaw chuck capacity, 9" swing, eight spindle speeds up to 4000 R.P.M.

HIGH SPEED PRECISION
SECOND OPERATION MACHINE

• A common error of production departments has been the purchase of large, expensive machines, capable of performing many operations — and then confine them to one use — second operation work. Immediately, the purpose for which the machine was purchased — many operations — is defeated.

Now the trend is to Hardinge — designed only for second operation work. The initial low cost, the versatility and unusual capacity, without the set-up complications involved with large machines, created an ever-increasing demand for this machine.

The double tool cross slide and turret take standard tooling. The six-position tilted turret has an automatic indexing and locking head with six independent travel stops.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
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OHIO PRODUCTION
MILLING MACHINES

There are now 14 Ohio Production Milling Machines in this plant. Such repeat orders are no doubt due to the features briefly sketched below.

● Its CONVENIENCE and ACCESSIBILITY make the Ohio Production Milling Machine versatile and profitable. On short runs it is easy to set up, operate, get at, and change over. Long runs prove it rugged, accurate, and enduring. The machine mills just as well *against* the feed as with it, thanks to true cutter rotation, a true plane of travel, rigidity, and positive locked feed. You can mill continuously without indexing fixtures. Climb-cutting prolongs service. Available are various cycles of automatic operation of the feed and rapid traverse.

THE OHIO MACHINE TOOL COMPANY • KENTON, O.

IMMEDIATE SHIPMENTS NOW

IMMEDIATE SHIPMENTS NOW

OHIO DREADNAUGHT
HORIZONTAL BORING, DRILLING AND MILLING MACHINES • SHAPERS • PLANERS

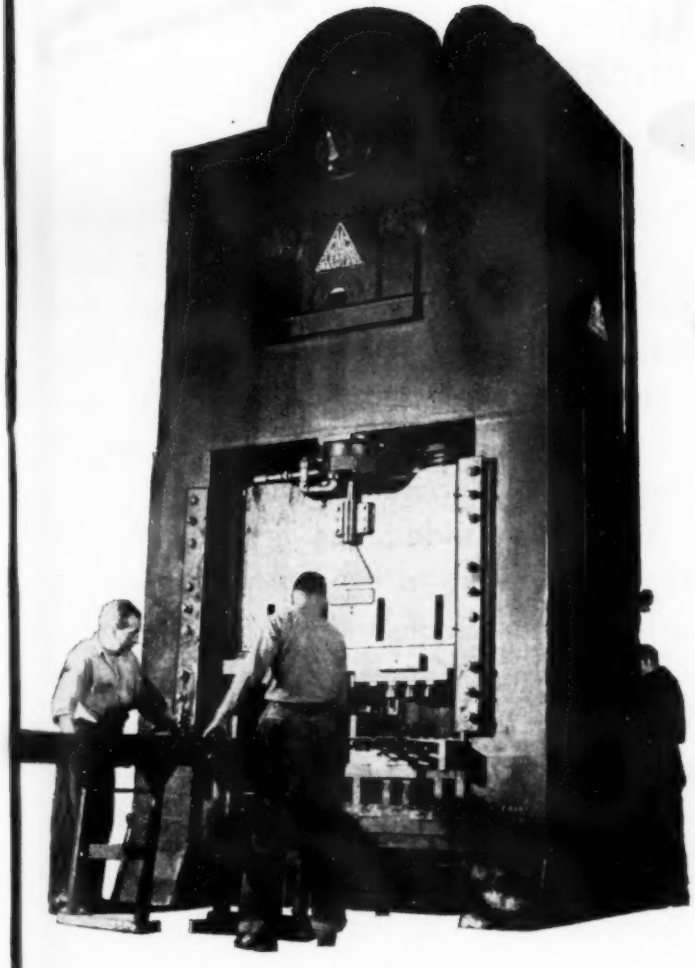
Lamps

THAT LIGHT THE WORLD

Aladdin's magic wish-giver served only one master. But the miracles of invention and production being achieved by American industry today bring bright hope to all of us.

To secure results considered impossible only a few short years ago, industry calls on modern genii—like Clearing Presses. Time after time, when only larger, more accurate presses could solve perplexing new production problems, the machines that solved the problem were Clearing Presses.

Production facilities and engineering ingenuity that make Clearing Presses so outstanding are capable of contriving those presses which can best do the job you want done. When you plan for the immediate or distant future—whenever you think of the "shapes of things to come"—you will find it profitable to enlist Clearing's expert advice and assistance.



Rapid production of portable landing field mats is the function of this 400 ton capacity Clearing Mechanical Press in one of the plants of the Morton Manufacturing Company. Countless other war jobs benefit from Clearing's ability to build presses specifically designed to do those jobs better.

CLEARING MACHINE CORPORATION
6499 W. 65th St., Chicago, Illinois

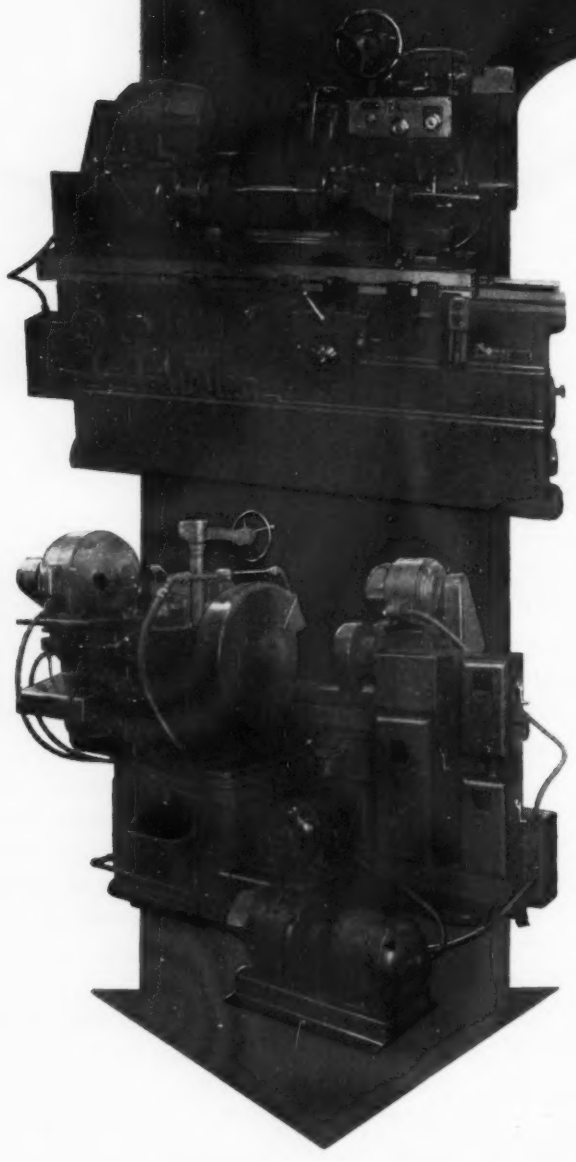
CMC CLEARING

FOR SHAPES OF THINGS TO COME

CLEARING

MECHANICAL AND HYDRAULIC PRESSES

A New FITCHBURG GRINDER



NEW IMPROVED FITCHBURG TYPE-B 10″ PLAIN CYLINDRICAL AUTOMATIC PRECISION GRINDER

The Fitchburg Type-B Plain Cylindrical Automatic Precision Grinder has been improved — into this new Type-B has been built new features for increased work production, greater accuracy, and finer finish.

New improved controls increase the ease of operation — push button controls are all located at the operator's finger tips.

It handles a wide range, and a number of types of jobs (up to 10 inch swing), and the automatic precision features leave the machine operator free to operate a second machine — *thus cutting man-hour cost on every piece produced.*

Write today for complete details and information.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders

FOR "PROOF OF THE PUDDING"

Ask a User about MID-WEST *Abrasives*

We claim MID-WEST abrasive products—honing and superfinishing stones, grinding wheels, sandpapers and lapping bricks – are the world's *most efficient* abrasives.

But we don't ask you to take *our* word for it. Instead, we prefer that you ASK A USER. Just ask any user why he prefers MID-WEST abrasives. He'll tell you they do their work faster, they last longer and they produce better finishes. That is another way of saying they are more economical, they increase production and they eliminate rejects.

MID-WEST honing and superfinishing stones, for instance, are made with MICRO BOND, a remarkable new abrasive developed by MID-WEST engineers, that positively insures uniformity of quality and performance. The MID-WEST manufacturing process provides precise control of grain and grade. MID-WEST stones are tailor-made stones—tailor-made for specific finishing jobs. That's why we say: ASK A USER!

If you have a superfinishing, honing or grinding problem in your plant let one of our service engineers solve it for you. One of them is as close to you as your nearest telephone.

Use our FREE flatness and surface finish measuring service. Send in your part. We'll return it along with our report on its flatness or surface finish. Ask for further details.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE **DETROIT, MICHIGAN**

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

Mid-West

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

*Name*_____

*Company*_____

*Address*_____

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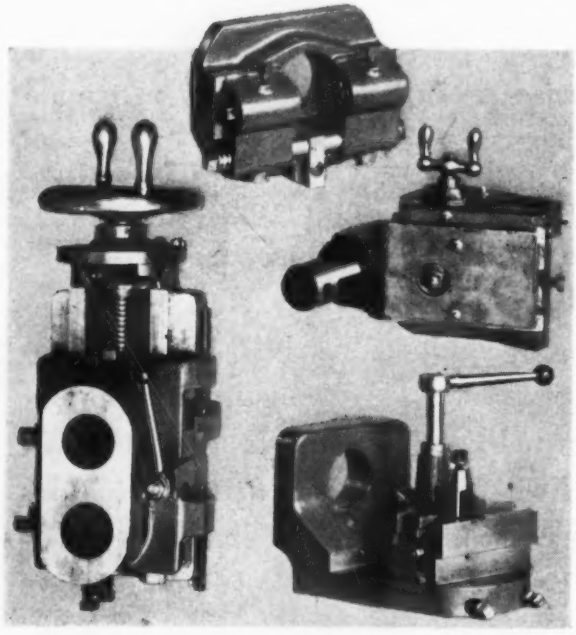
It takes the correct tools to do the job right

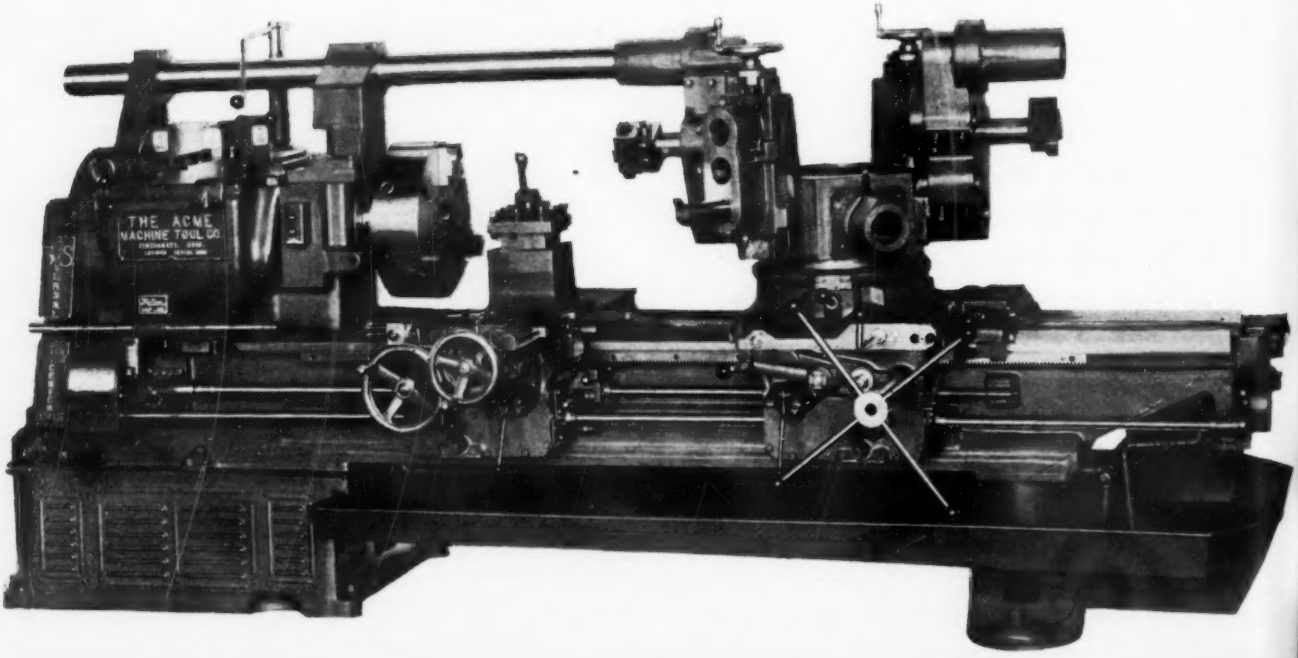
CINCINNATI ACME TURRET LATHES



• This group of heavy duty tools and holders give Acme Turret Lathes a greater working range—provide closer tolerances and increase production.

The rigidity and massive design assures ample support to tools and freedom from vibration and chatter on heavy cuts. All tools and holders shown are adapted for use on the No. 3S Universal Acme Turret Lathe illustrated.

These tools are as follows . . . No. 1 Knurling Tool 3½" capacity . . . No. 2. Vertical Slide Tool . . . No. 3. Angular Chasing Tool Holder for Side Carriage . . . No. 4. Adjustable Angle Rack Tool.



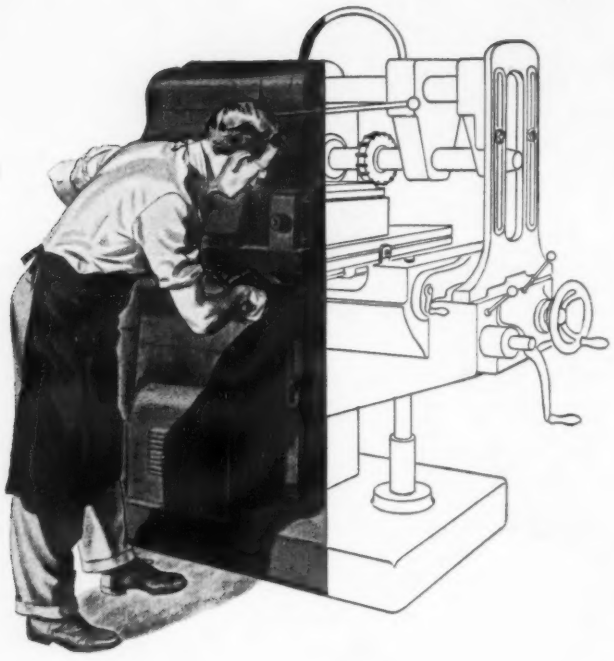
The ACME MACHINE TOOL CO.
CINCINNATI, OHIO.

GOOD OPERATORS
never use dull tools!

KEEP ALL CUTTING TOOLS SHARP!

Dull tools result in poor finish and rejected work.
They waste power and vitally needed tool steel.

★ *Reprints of this page are available for bulletin board use in your turret lathe department. Write the Gisholt Machine Company, 1201 East Washington Avenue, Madison, Wisconsin. Ask for "War-Time Care and Operations poster No. 3." State quantity required.*



Getting Work Out of the OTHER HALF

This is half a machine. It cost full price, takes up full floor space, uses full operator's time—but it's just half a machine. That's because it is handicapped by a slow setup and removal cycle. It delivers only a part of its potential output.

One of the most important duties of **HECKER** tools, jigs and fixtures is to convert stand-still time into production.

The **HECKER** tool engineer takes account of the worker, the machine and the requirements of the job. Then he designs a tool to bring those three vital factors into the best possible adjustment.

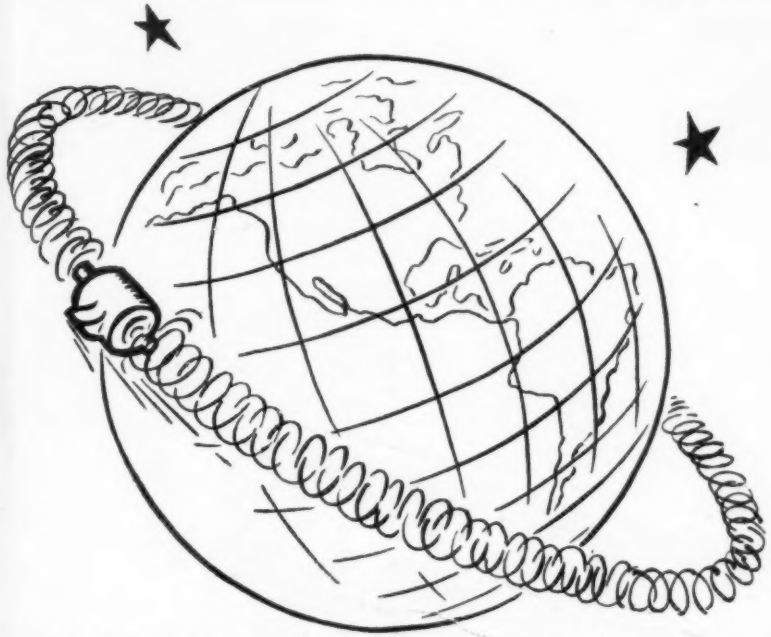
HECKER tools have other purposes, too. It depends on the results wanted. Tools for inexperienced workers; tools to improve quality; tools to speed operating cycles; in short, custom-designed tools, built to the specific problem.

These engineers can see their own designs in daily operation on precision aircraft parts in the **HECKER** plant. That's an extra advantage in firsthand production experience which can help you get more work out of the "other half" of your machines. By way of demonstration, turn a real tooling problem over to **HECKER**—judge for yourself. Write (wire or phone if urgent) to A. W. Hecker, 1982 East 66th Street, Cleveland, Ohio; or, 517 New Center Building, Detroit, Michigan.

A★W★ *Hecker*

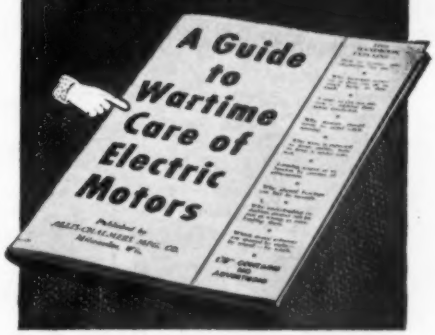
DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES . . . FABRICATORS OF AIRCRAFT PARTS

Some Job to Keep Motors Rolling at This Rate!



'ROUND THE WORLD EVERY 8 DAYS — That's the rim travel of a rotor in many electric motors working on the new 24-hour-a-day, 7-day-a-week "suicide schedule"!

Now, that U. S. motors are working up to 3 and 4 times as many hours a year as in peacetime, they need wartime care! Send in to Allis-Chalmers for your free copy of "A Guide to Wartime Care of Electric Motors." It's packed with the new data you need today!



HERE ARE THREE OF A MOTOR'S MOST DANGEROUS ENEMIES . . .

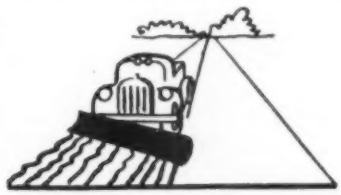
1. Overload—Now that motor overrating is U.S. policy, a closer eye than ever

must be kept on a motor's overload protection. Like an overloaded horse, a motor worked too far beyond its horsepower capacity is sure to break down. See page 16 of "A Guide to Wartime Care of Electric Motors" for helpful tips. Already, wartime industry is using over 80,000 copies of it!

2. Friction—Standard peacetime instructions for guarding motors against friction were based on 8-hour-a-day, 7-day-a-week operation. Those instructions are dangerously obsolete today! All your maintenance men

should read the articles on "Dust" and "Friction" in Allis-Chalmers' new motor maintenance guide. It's profusely illustrated (with easy-to-understand sketches like these above).

3. Uneven Wear— Just as "rutting" is fought in road maintenance, "grooving" must be fought in *motor* maintenance. For on commutators and slip rings, smooth and even wear is *slow* wear. Every man in your maintenance department should know "A Guide to Wartime Care of Electric Motors" forward and backward. Send in today for *your* free copy to ALLIS-CHALMERS MFG. Co., Milwaukee, Wis.



ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

A 1590

Tools GET A NEW LEASE ON LIFE

SUNICUT

"increases tool life 70% . . . improves finish!"

Now it's a production race to make every man-hour count . . . to make every machine produce at maximum capacity. And in many plants throughout America Sunicut has provided the answer!

Take one plant that switched to Sunicut as an example. They had been using a competitive cutting oil on their Jones & Lamson turret lathes for turning and threading. Tool life was poor . . . finish was not satisfactory. But all of this stopped when a Sun Oil Engineer—one of those Doctors of Industry—had them change to Sunicut.

Now with the superior metal wetting and heat absorbing qualities of this transparent sulphurized Sunicut cutting oil, tool life has been increased 70% . . . finish greatly improved.

Help your shop get the most finished pieces between tool grinds . . . save tool steel and reduce costly rejects . . . make every man-hour and machine-hour result in peak production. Call in a Sun Doctor of Industry. Let him show you the production value of Sunicut. Remember, his services are yours to help improve the output of your plant. Just write . . .

SUN OIL COMPANY, *Philadelphia*

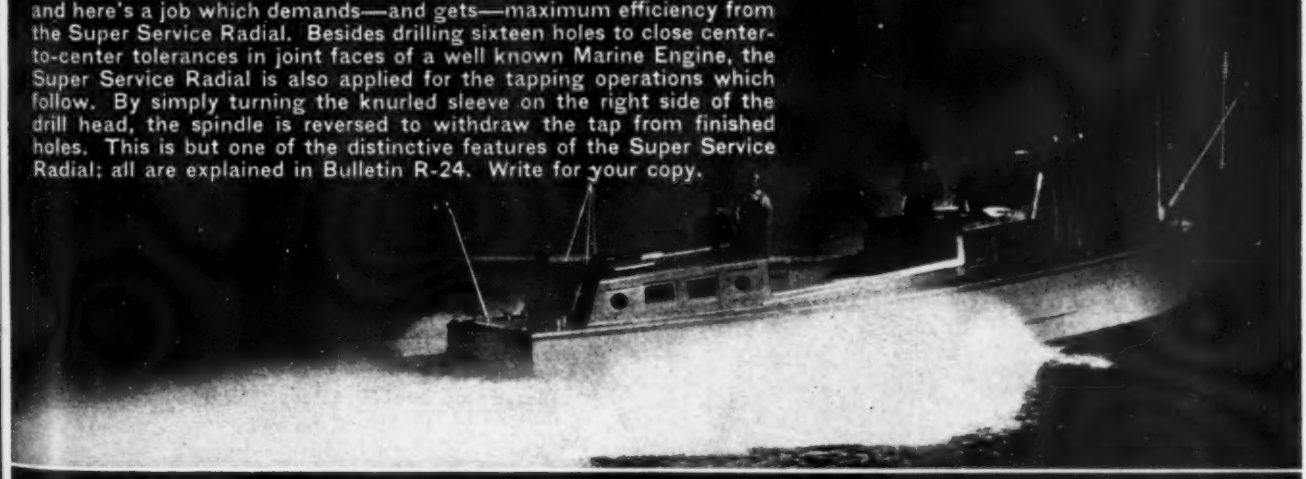
Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AMERICA*

MARINE ENGINE MANIFOLDS
DRILLED and TAPPED WITH A SUPER SERVICE RADIAL

Wartime production demands the most work from a machine tool . . . and here's a job which demands—and gets—maximum efficiency from the Super Service Radial. Besides drilling sixteen holes to close center-to-center tolerances in joint faces of a well known Marine Engine, the Super Service Radial is also applied for the tapping operations which follow. By simply turning the knurled sleeve on the right side of the drill head, the spindle is reversed to withdraw the tap from finished holes. This is but one of the distinctive features of the Super Service Radial; all are explained in Bulletin R-24. Write for your copy.



THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

Even the "Experts" Were Stumped IN A QUIZ ON BAR TURNERS

Do you run into oversized or undersized diameters?

Are you ever troubled with "barber-pole" or "Chinese-writing" finishes?

Ever have a "lump" at the start of a cut?

Ever cuss at the "sloppy fit" of re-ground cutters?

THE Warner & Swasey Single Cutter Bar Turner sees more service than any other tool used in turret lathe setups for bar work.

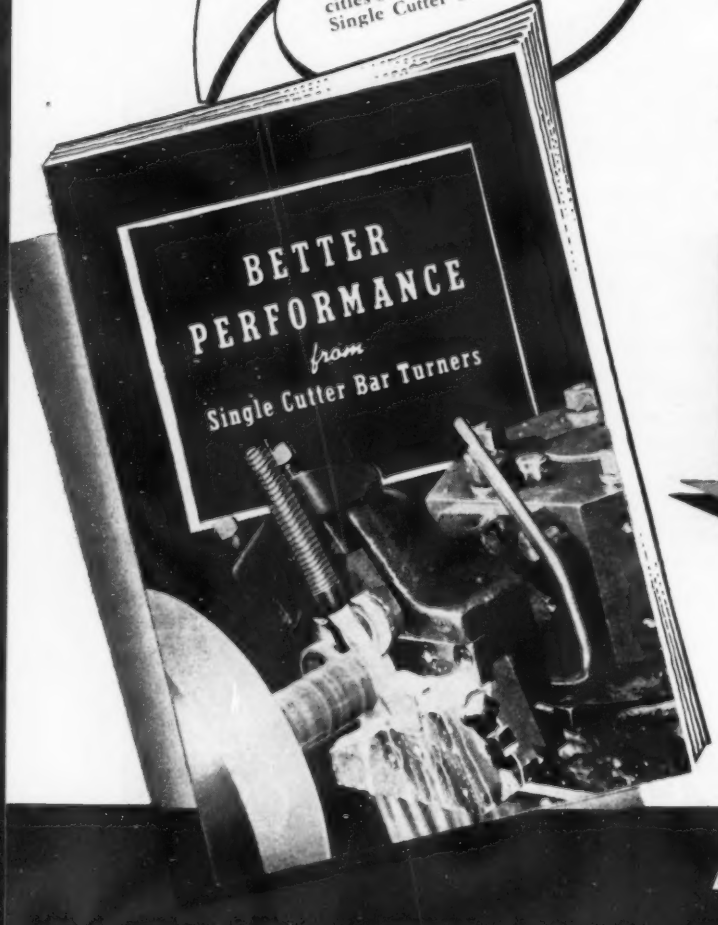
Job studies of this tool in action in plants all over the country disclosed to our field men the urgent need for a better knowledge of the mechanical details in the tool itself, and a better understanding of its usage.

Many operators were not getting the best performance from the tool because simple adjustments were overlooked, cutters were improperly ground or wrongly positioned.

This is no reflection upon these operators. Even the master machinist or veteran setup man can learn things about this important tool that he probably didn't know before.

That's why a 32-page booklet about the Single Cutter Bar Turner has been written and is offered by Warner & Swasey as a guide to better finishes and increased production.

This new 32-page booklet just off the press will help eliminate those troubles. It is packed with information, helpful hints, illustrations, and diagrams that will give you a better knowledge of the versatility and capacities of your Warner & Swasey Single Cutter Bar Turner.



Use the Handy Coupon — Mail Today —It Will Bring the Single Cutter Bar Turner Manual Promptly.

WARNER & SWASEY
Turret Lathes
Cleveland

Warner & Swasey Operator's Service Bureau, Cleveland, Ohio
Please send booklet, "Better Performance from Single Cutter Bar Turners".

Name _____

Address _____

City _____ State _____

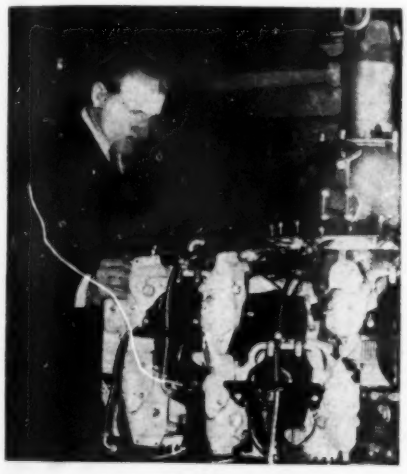
AM-14 I work at (Company) _____

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

DIES BY THE UNSKILLED

Skilled toolmakers aren't necessary to the production of a new type of die, which is steel faced with plastic backing plates and is made directly from templets. Tooling time is materially reduced, and along with considerable savings in metal the dies are light enough to be handled by women operators. The uses and procedures followed in making these dies are described in an article by Roi Kennedy, Vega Aircraft Corporation. Page 83.



C. C. WHITLACH

CONVEYORS SMOOTH THE WAY

In a special department of the Tulsa Plant of the Douglas Aircraft Company, devoted to the preparation of engines for mounting on airplanes, power units move easily through the various stations on specially designed conveyors, carriers and dollies. Careful attention to design of this line has resulted in continuous and speedy operation through the steps of cleaning, testing and installation of parts and subassemblies. The manner in which Douglas has combined modern assembly technique with railroad switching yard practices, to gain a smoothly flowing department, is described in an article by C. C. Whitlach, of the Douglas Aircraft Company. Page 121.

WHILE OTHERS FIGHT

Even with the United States "up to its armpits" in war, workers continue to take time off to go fishing or hunting, to shop for necessities or just to spend the overtime pay that is burning holes in their pockets. Some absenteeism is caused by failure of the community or plant management to make adjustments to fit the needs of shift workers, or to aid them in solving personal problems of housing or the care of dependents. Much of it is caused by the workers' failure to grasp the importance of the labor of each to the war effort. Each plant management has sought to cope with the problem—for it is generally widespread—and the outcomes of the various absenteeism-combating schemes makes interesting reading. Page 90.

SMALL-LOT METAL CLEANING

In the third of a series of articles on metal cleaning, D. R. Mitchell, technical director, and Marcel T. Zinty, chief engineer, Machine Division Magnus Chemical Company, describe the heating, agitation, draining, skimming and ventilating methods for simple cleaning tanks for small-lot metal washing. Page 94.

IMPROVES PLATING METHODS

Precise plating of large quantities of vital parts of the Pratt & Whitney aircraft engine is being done under new practices adopted at the Melrose Park plant of the Buick Division of General Motors. The methods employed are not only accurate, but increase plating production several times. The steps Buick uses in giving parts a protective coating of metal are described by Herbert Chase. Page 97.

TAKING WORK TO THE WORKERS

It would be virtually impossible to write of Consolidated Aircraft Corporation's new feeder plants, established in areas with untapped sources of labor, without referring to Mahomet and his stationary mountain. On the basis of exhaustive surveys by the U. S. Employment Service and Consolidated employment experts, the company set up parts manufacturing plants in communities previously untouched by war industries. The plan taps virgin labor supplies, and operation is with the same efficiency as prevails in the parent plant. An article describing the set-up commences on page 88.

THE REFERENCE BOOK SHEETS

Common faults in arc welding are illustrated, and rules for obtaining satisfactory butt and fillet joints are given in the Reference Book Sheets, written by C. H. Jennings, Westinghouse Electric & Manufacturing Co. Mr. Jennings is considered one of the outstanding authorities on electric arc welding; he is the author of numerous articles on welding and two books—"How to Weld 29 Metals" and "41 Lessons in Arc Welding." Page 129.

CHARLES H. JENNINGS

COMING

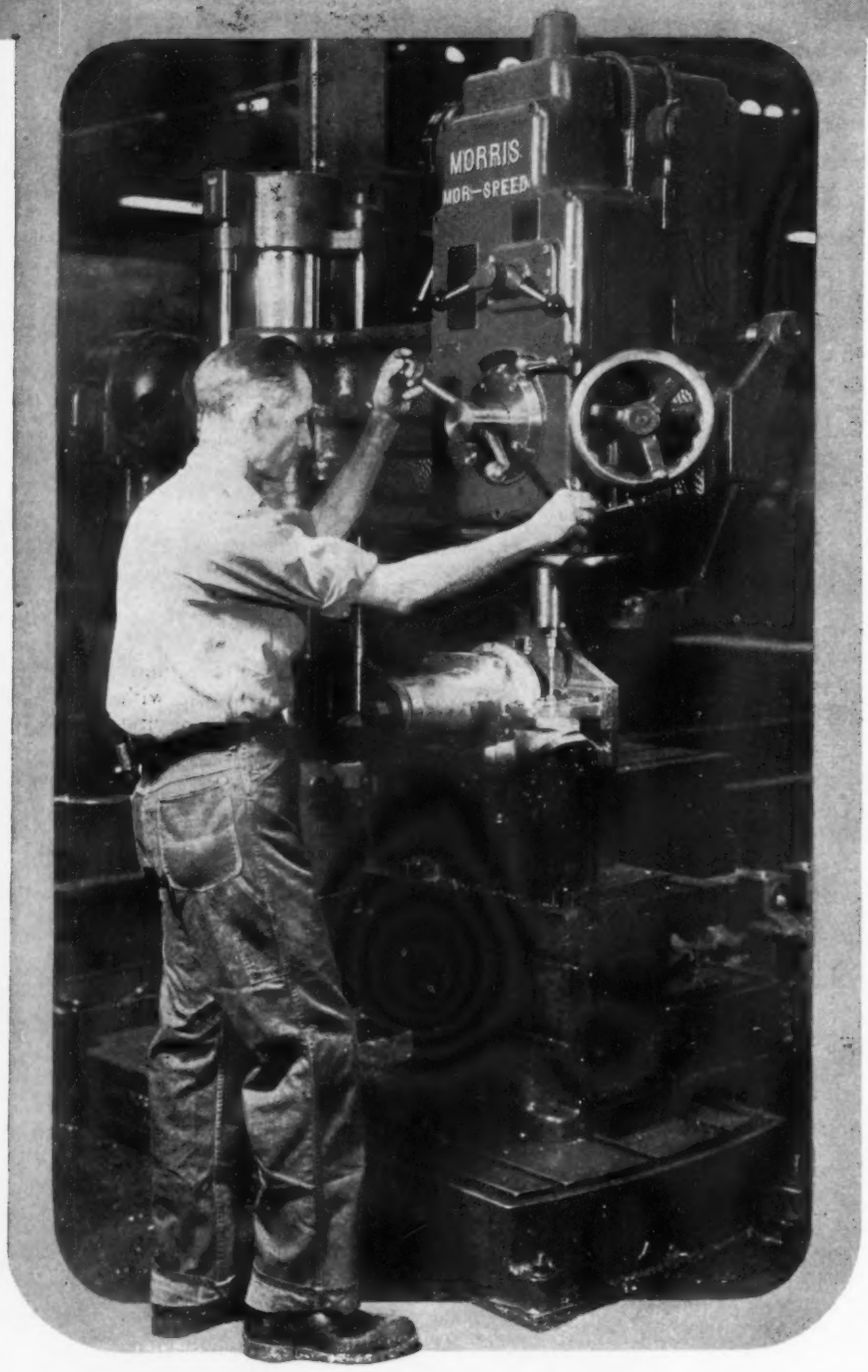
The aircraft industry has developed a real technique of tooling, along with an understanding of the underlying principles. During the initial stages of tooling, speed of getting into production was the main consideration, with the result that fixtures were sometimes so designed as to be wasteful of manpower. Today, faced with manpower shortage, and relying increasingly on the hiring of women, retooling is patterned to economize on labor and to lighten the load of the worker. In an article to be published in the near future, Consolidated Vultee Aircraft Corporation's retooling for subassemblies of the Coronado flying boat will be described.

As manpower flows from the unessential industries to those which contribute directly to the furtherance of the war effort, personnel workers find themselves faced with the necessity of making conversions of skills. To fit an applicant to the type of work for which his background best suits him, they consider the mental and physical attributes he will have developed. From there on, the problem is but one of adapting his basic characteristics to the details of his new work. How this is being done will be described in an early issue.

A simple sum provides the logical answer with

MORRIS MOR-SPEED RADIALS

BALANCE + RIGIDITY = PRECISION PERFORMANCE



• Even with the head operating at the end of the arm Morris Radials assure precision performance. The heavy, well-balanced arm and rigid construction from base to column top assure accurate work under heavy feeds and high spindle speeds.

Other important construction points contributing both to high speeds and productive capacity are—all controls on the head within easy reach — all speeds and feeds in the head made through sliding gears with broached holes, on spline shafts mounted on Timken Roller Bearings — and forced feed lubrication throughout the head.

For simplicity of operation—accuracy and all around capacity—make your next Radial a Morris Mor-Speed.

Full details as to design and construction and other engineering and operating data are included in the Morris Mor-Speed Bulletin. Write for yours—today.

Standard Sizes include 9"-11" and 13" columns.

PRATT & WHITNEY exclusive sales representatives for MOR-SPEED RADIAL DRILLS in the U. S. A.

MORRIS MACHINE TOOL CO.

25 years' experience in designing and building special high production Drilling, Boring, Reaming and Tapping Machinery for the automotive and other industries.

CONSULT OUR ENGINEERS ON PRODUCTION PROBLEMS

Builders of MOR-SPEED *Radials*

The MORRIS *Machine Tool Co.*

CINCINNATI, OHIO

ESTABLISHED 1877 AMERICAN MACHINIST BURNHAM FINNEY, Editor

Plastic Reduces Cost of Piercing Dies

Holes may be punched in sheet-metal parts by tools which can be produced quickly, cheaply and are easily handled by women

BY ROI KENNEDY, TOOL RESEARCH ENGINEER, VEGA AIRCRAFT CORPORATION

A NEW TYPE OF DIE has been added to the aircraft industry's already impressive record for devising short-cuts in sheet-metal tooling. Reduction in tooling time is only one of the advantages of this development. Others are savings in steel, lightness and remarkable economies in production costs. The dies can be made by inexperienced operators, an important consideration when skilled toolmakers are scarce.

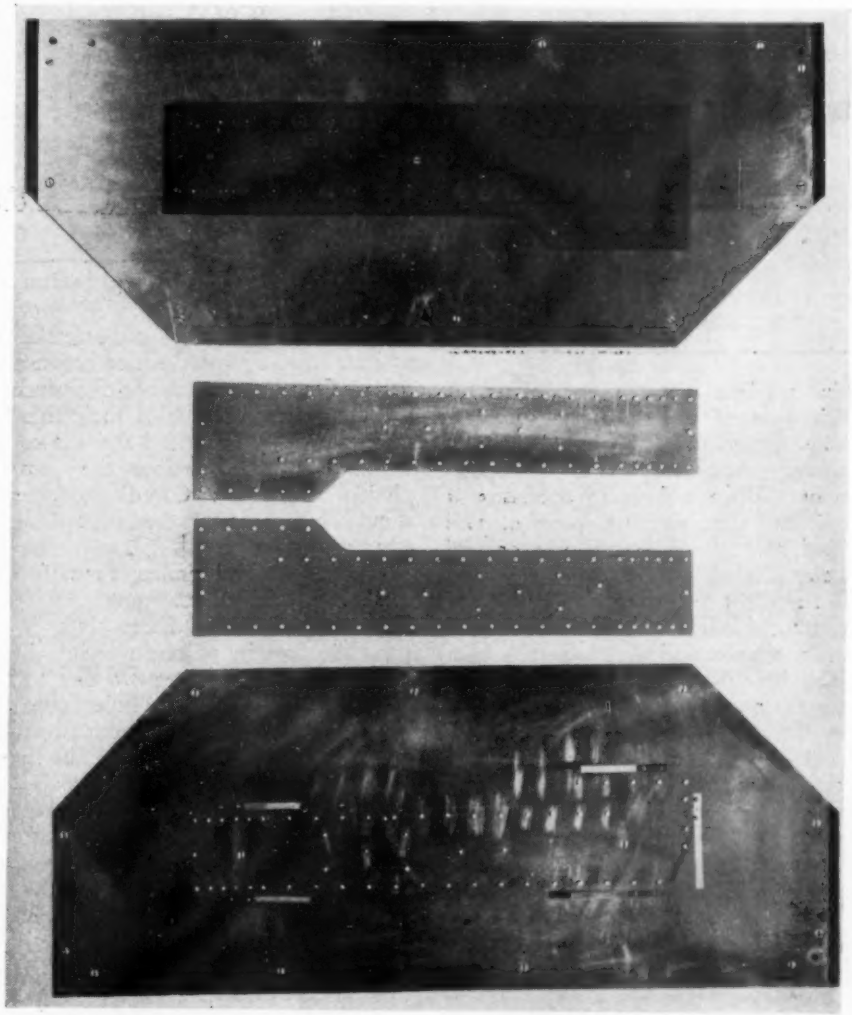
These tools, devised by the Vega Aircraft Corporation, are called "templet piercing dies" because of the fact that they are made directly from templets and their present application has been on piercing operations. Further developments may show that the same principles can be applied to blanking and forming, but that is getting ahead of the story.

The outstanding feature of this method of tooling is the use of laminated plastic backing plates with a thin facing of steel, thus combining the durability of the steel with the lightness of the plastic. An average die using this construction saves four-fifths the weight of a corresponding all-steel die. Thus a set of all-metal piercing tools, weighing 100 lb., will come to only 20 lb. with the steel-plastic combination. Since women handle such tools today, the weight-saving alone makes the innovation decidedly attractive. A typical application for piercing 130 holes in a sheet aluminum part required only 14 hours of toolmaking, using unskilled help.

The maximum stock thickness that has been pierced by this method is 0.102 in. for aluminum alloys (ST) and 16 gage (0.065) for stainless steel. No limitations are made as to the maximum size of holes to be pierced. However, the greatest advantages are obtained when this type of die is used for piercing small holes, such as rivet and bolt holes, which may be coordinated, either pilot or full sized, with holes in mating parts.

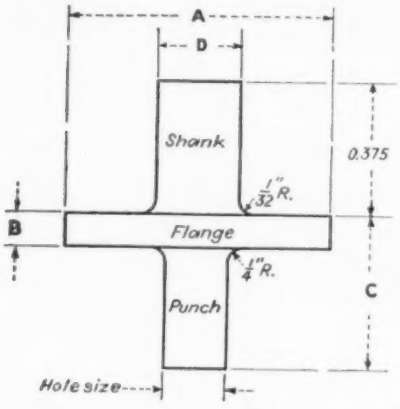
Small holes may be pierced with special punches (Fig. 1) made from carbon steel drill rod that can be readily turned out in a screw machine when the quantity warrants. Large diameter holes generally require the use of a $\frac{1}{4}$-in. shank carbon steel punch in place of the standard type. Irregularly shaped holes are usually made with a carbon steel punch $\frac{1}{4}$-in. thick, screwed and doweled in place.

Parts that may be straight sheared to



Assembled punch and die plates are shown with two blanks pierced by them

Fig. 1—A special punch made of drill rod is the key to the success of the templet pierce die. It is accurately positioned by the shank while the wide flange takes the piercing thrust



1. End of punch must be sharp and square with shank
2. Harden to Rockwell C55-C58
3. No grind needed after hardening

Shank dimensions *D* allow 0.001 to 0.002 in. for a press fit in the following size holes in the punch plate and backing plate:

D Diameter	Hole Size in Punch and Backing Plate
0.126 0.127	1/8 (0.125)
0.189 0.190	3/16 (0.1875)
0.251 0.252	1/4 (0.250)

size are best adapted for piercing on this type of die since the complete hole pattern may be pierced simultaneously, thus saving radial drill operations. When a forming operation is required after piercing, parts of this kind may also have the pin or tool holes pierced.

Parts that require routing because of contoured edges may be sheared to a stock templet and then have the complete hole pattern, including pin holes for the router blocks, pierced followed by the routing operation.

A common practice in aircraft fabrication has been to drill pilot holes in one of the parts; then with the drilled part in the assembly jig in contact with its mating member, the pilot holes are opened to a larger size with a portable drill which also puts the hole in the mating part. This practice means a duplication in machining time and prolongs the period in which the assembly must be kept in the jig, usually a limiting factor in aircraft production.

PUNCH DIMENSIONS IN INCHES

Diameter	Material	Thickness	A	B	C	D
3/32 to 1/4	Aluminum Alloys	0.016–0.064 (Inc.)	3/8	3/32	11/32	0.126
	Stainless Steel					0.128
1/4 to 1/2	Aluminum Alloys	0.016–0.064 (Inc.)	9/16	3/32	11/32	0.189
	Stainless Steel					0.191

Note:
Piercing punches for holes above ½-in. diameter in all steel and aluminum alloys should have the following approximate dimensions: *A*—Diameter to be pierced plus $\frac{3}{16}$ (0.1875). *B*—$\frac{3}{32}$ (0.0937). *C*—$\frac{11}{32}$ (0.3437). *D*—(0.251–0.252).

PUNCH CLEARANCES FOR THE DIE PLATE

Stock Thickness	ST — Dural (6% Clearance)		Stainless Steel (2% Clearance)		SO — Dural (3% Clearance)	
Inches	Die Clearance	Cl. One Side of Punch	Die Clearance	Cl. One Side of Punch	Die Clearance	Cl. One Side of Punch
1/64	0.0015	0.00075	0.0005	0.00025	0.0005	0.00025
1/32	0.002	0.001	0.0008	0.004	0.0008	0.0004
3/64	0.003	0.0015	0.001	0.0005	0.0015	0.0008
1/16	0.004	0.002	0.0015	0.0008	0.002	0.001
5/64	0.0045	0.0025	0.0015	0.0008	0.002	0.001
3/32	0.005	0.0025	0.002	0.001	0.003	0.0015
7/64	0.006	0.003	0.002	0.001	0.0035	0.0018
1/8	0.007	0.0035	0.0025	0.0012	0.004	0.002

NOTE: Careful use of this chart will hold hole burrs to a minimum.

Use of templet piercing dies makes possible full hole coordination between parts. Coordination is positive since the die plates, because of their thinness, can easily be mated and the coordination proved before the completion of the die. Coordinated dies should be made at the same time whenever possible.

Wing skins and similar parts, formerly radial drilled, may now have the hole pattern pierced. Large skins beyond the capacity of one piercing die may be pierced by using two dies and piercing a portion of the hole pattern on one die and indexing from two to five of these holes for alignment on the second die.

Changes in hole pattern, such as are encountered in experimental work or modification, can be accommodated easily because of the speed in which a punch may be removed or added. Worn or broken punches can be quickly and easily replaced. This step involves only the removal of a few screws and can usually be accomplished in less than 5 min.

The procedure for making templet piercing dies is as follows:

The two backing plates are sawed from ½-in. laminated phenolic plastic to a size suitable for carrying the hole pattern. Their limiting dimensions are ordinarily made to conform to the standard die sets to which they are fitted (Fig. 2). Then the steel punch and die plates are attached to the backing plates, using ½-in. countersunk machine screws placed from 6 to 8 in. apart, and ½ in. from the edge of the plate (Fig. 3). Attachment screws for the die plate should be located midway between those in the punch plate. Attachment screws should also be used around die holes ½ in. and over to prevent a separation between the die plate and the backing plate.

A separate or extra steel die plate should be made while working the die to be used as a replacement when considerable production is anticipated.

The following material has been found satisfactory for the punch and die plates:

16 gage (0.065 in.) annealed SAE

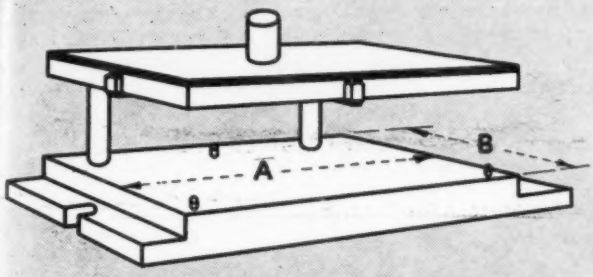
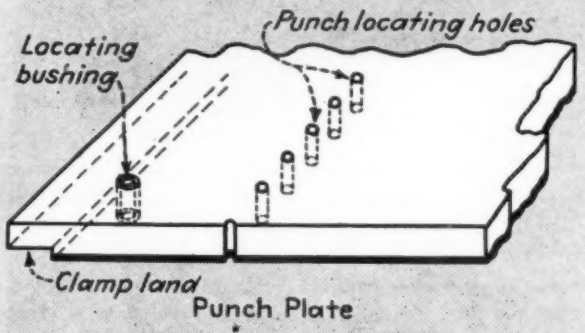


Fig. 2 — Backing plates for templet piercing dies are made to conform to the limiting dimensions (*A* and *B*) of standard die sets. They are located by dowel pins



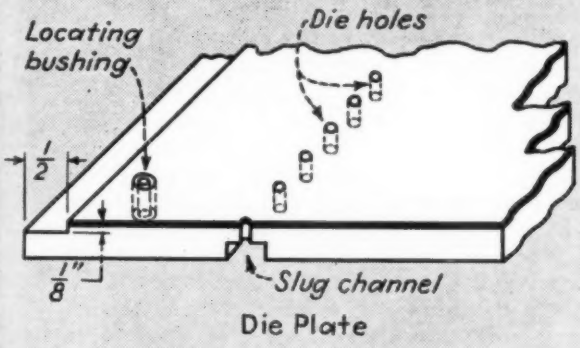


Fig. 4 — Typical die plates show how the holes are coordinated and how the slug channels are routed

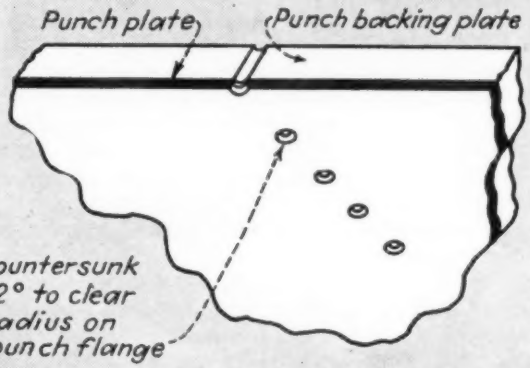


Fig. 6 — Holes in the punch plates are enlarged to receive the punch shanks with a press fit and countersunk to clear the shank fillets

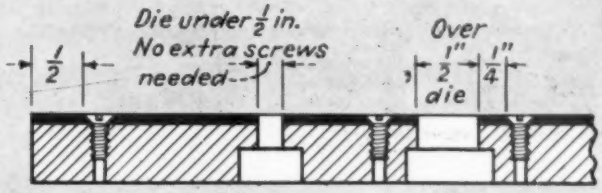


Fig. 3 — The steel die plate is held to the plastic backing plate by 1/2-in. screws spaced 6 to 8 in. apart and around die holes over 1/2 in. in diameter

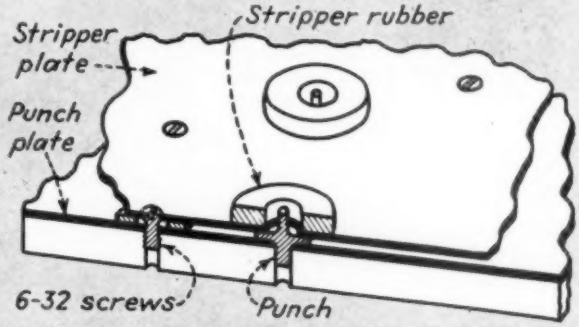


Fig. 5 — Stripper plates hold the punches in place and serve as a base for glueing the stripping rubber. This design is for small punches (0.098 to 0.159 in.)

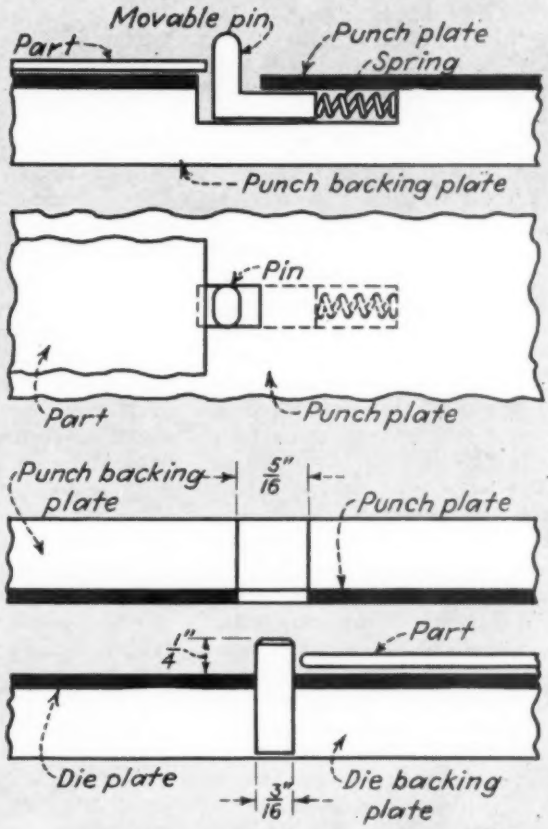


Fig. 7 — Blanks are located on the die plate by nesting pins. The plain pin (left) is stationary while the movable pin (right) has a spring backing

1010 steel for aluminum alloy parts on runs up to 2,000 parts or for stainless steel parts on runs up to 500 parts.

16 gage (0.065 in.) SAE 1010 steel (heat-treated in a cyanide bath for 8 min. to 1550–1600 F. and quenched in oil. This heat-treatment gives a file hard surface on a ductile steel with very little warpage—which can be straightened easily) for aluminum alloy parts on runs of 2,000 to 8,000 parts, or for stainless parts on runs over 500 parts.

Die plates should be the same size as the backing plates being used (Fig. 4). With the steel punch and die plates stacked together with a standard die set templet, holes are drilled for three $\frac{1}{4}$-in. temporary locating pins. These pins are a slip fit in the plates. The backing plates are also drilled and bushed, coordinated to the steel punch and die plates already drilled for location on the standard die set in which they are to be used. The standard die set with its $\frac{1}{4}$-in. locating pins is thus coordinated to the die proper, insuring quick set-up of the dies to the die set.

The stripper plate which is usually 20 gage (0.037 in.) automotive body metal is then attached to the punch plate with $\frac{1}{2}$-in. countersunk machine screws threaded into the backing plate and made flush and smooth with the stripper plate surface (Fig. 5). The shape of the stripper plate will vary according to the size and shape of the part to be pierced. Attaching screws in the stripper plate should be spaced approximately every 6 in.

With the stripper plate in place, the die plate and the punch plate are again stacked together and located by the temporary locating pins. The drill templet for the production part is placed on top of the punch backing plate, while the part hole pattern is drilled through the entire stack, the holes being sized for punch clearance according to the accompanying table.

The punch plate is taken off the stack and the stripper removed while the holes are opened to fit the shanks of the punches (Fig. 6). When drill sizes are not correct holes can be opened by punching from the bottom up in a standard Wiedemann turret punch press with specially sized punches. All punch locating holes are countersunk to clear the radius on the punch flange. It is important that each flange rests flat on the punch plate.

Slug removal channels for blowing out punch slugs from between the backing plate and die sets are then routed in the lower part of the backing plate. The channels should be approximately $\frac{1}{4}$ in. in depth and upward from $\frac{1}{4}$ in. in width depending upon the slug size. Channels should never be over $\frac{1}{8}$ in. wider than the diameter of the slug to facilitate removal. A hand router or end mill can be used for cutting the slug removal channels.

All slug holes entering the channel should be countersunk 82 deg. by $\frac{1}{8}$ in. larger than the slug clearance hole diameter to prevent chipping the backing plate when the slugs are ejected.

Whenever possible the slug removal channels should be located in straight lines extending across the entire backing plate. If it is impractical to use straight channels, because of a scattered or curved hole pattern, the channels should be made by attaching spacer blocks to the bottom face of the die backing plate. These spacer blocks should be so located that definite channels are formed for blowing out the slugs. Such spacer blocks should be attached to the backing plate with $\frac{3}{4}$-in. countersunk machine screws, taking care not to drill into the die plate. All screw heads must be flush or slightly below the bottom face of the spacer blocks.

Spacer block material should be the same as used for the die backing plate, and should never be over $\frac{1}{2}$ in. thick.

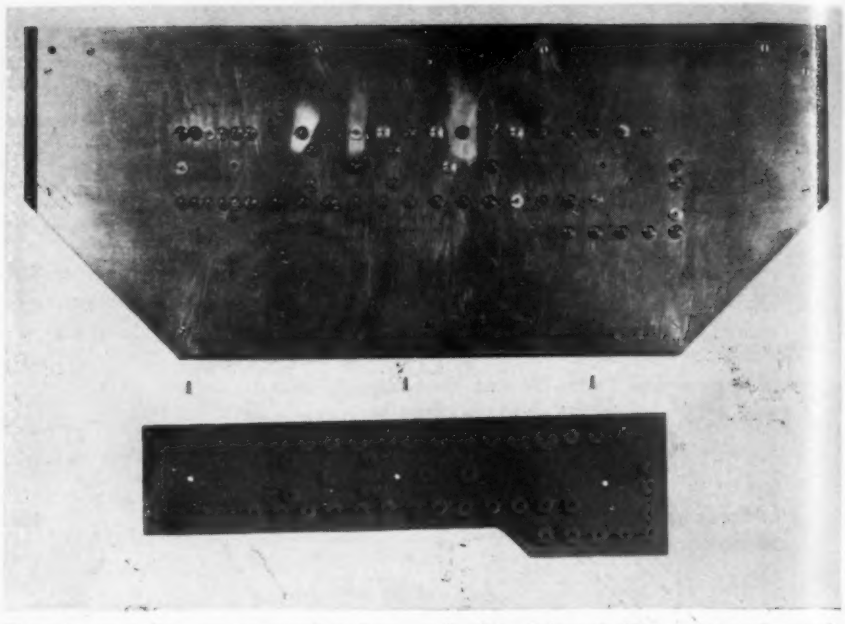
Nesting pins $\frac{3}{16}$ in. in diameter should be located on the die plate to provide a positive means of locating the part blanks in relation to the hole layout and permit easy removal of the part after piercing (Fig. 7). Pins should be located so there is 1/64-in. clearance between the edge of the pin and the part templet when the pin is installed. They should extnd a maximum of $\frac{1}{4}$ in. above the top surface of the part blank when in position. A $\frac{5}{16}$-in. diameter or larger hole in the punch plate and stripper plate should be used as clearance for the nesting pins. When piercing router parts on which variance will occur in the trim, a spring-loaded movable pin located on the part edge requiring the least amount of location is necessary.

The stripper plate acts as a base for glueing the stripping rubber ($\frac{1}{4}$-in. Neoprene, 60–70 Shore hardness) and as a punch retainer to prevent a loose or broken punch from falling out causing damage to the die or press. The amount of rubber required around the punch will vary depending upon the material being pierced and the punch size. About $\frac{1}{4}$ in. of rubber around each small punch is recommended.

A $\frac{5}{8}$-in. diameter spacer, the same thickness as the punch flange, is used under the stripper plate. This piece may be spot-welded to the stripper plate. If desired, a spacer plate may be used with holes drilled in it large enough to clear the punch flanges.

A study of this type of die will at once make evident its advantages. The pressure of the punches is taken on the punch plate to the large flange. The punches are a press fit in this plate and may be removed by pliers after the stripper plate has been taken off.

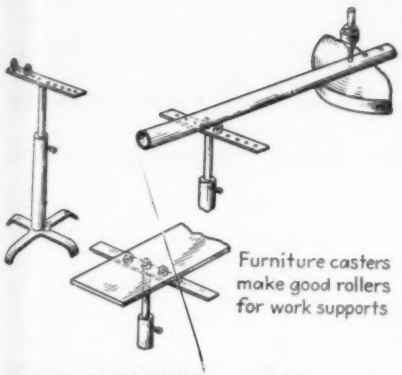
On the basis of actual experience 1,600 parts can be pierced, using an annealed steel die plate; for the regular longer runs a hardened die plate is used. The use of this type of die beats stack drilling with a radial drill by a time ratio of at least fifteen to one.



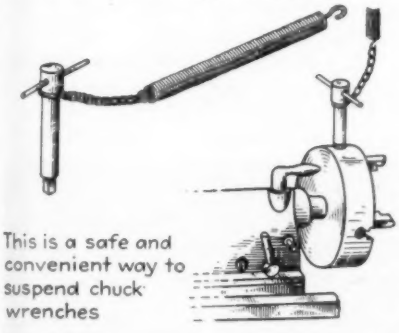
Piercing punches are inserted in the punch plate (above). The stripper (center) attaches to the punch plate by three screws. The die plate (lower) is aligned with the punch plate by guide pins through three bushed holes

SHORT CUTS FOR THE SMALL SHOP

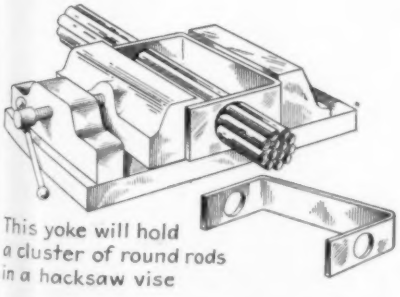
BY A. H. WAYCHOFF



WORK SUPPORTS at drill presses, punches and shears can utilize ordinary furniture casters. Take a typical work stand, which can be adjusted for height, and make a flat-bar support as shown in the drawing. Drill ⅜ or ½ in. holes in this bar about ¼ in. apart. Casters can be placed in these holes as desired to support round, square, hexagonal or flat pieces in a horizontal position.

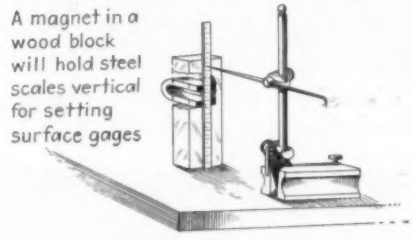


A SPRING suspension chain for a lathe chuck wrench, makes the wrench always available, and is a positive safety device because the wrench will never remain in the chuck after it has been used. The wrench is fitted with a slip ring, a short length of chain, and a light spring such as used to close screen doors. The spring can be affixed at a suitable place directly above the chuck.

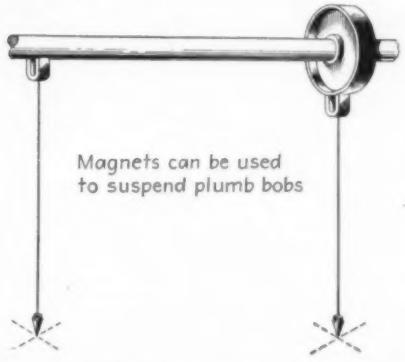


POWER HACKSAWS can be used to cut a number of round rods at one time. Make a yoke, as shown in the drawing, so that the distance between the legs is wider than the vise jaws. Slip the rods through the holes in the legs of the yoke, and place the assembly in the vise with one jaw clamping the rods and the other jaw clamping the back of the yoke. The rods will be held firm enough to withstand the pressure of the saw blade.

WEDGES welded to chisels will speed the cutting of rivets and bolts. Bevel the back of the chisel's cutting edge to take the wedge. After welding, the wedge will hold the chisel at the best position for cutting, and since the base of the wedge is parallel with the work, damage to the work is minimized if not prevented.

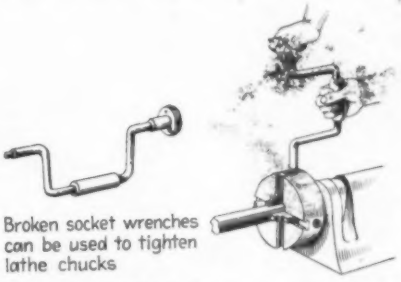


SURFACE GAGE SETTINGS often require the use of a steel rule held vertically on a surface plate or machine table. Slight errors in setting the gage, caused by angularity of the rule, and the inconvenience of holding the rule by hand can be overcome by placing it against a straight wood block into which a magnet has been inserted.



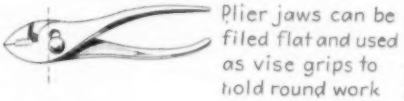
PLUMB BOBS are used to line up shafts and pulleys. It is often difficult to find a place to tie the line so the plumb bob will hang true. This can be simplified by drilling a hole in a small magnet for tying the plumb line, and suspending the bob as shown in the drawing.

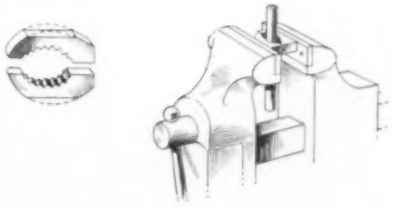
FILE HANDLES invariably become loose after a little use. To make them tight, center punch a myriad of holes on both sides of the tangs, apply glue, and insert the files in the handles.



CHUCK WRENCHES can be made from broken speed wrenches. Cut off the broken sprocket and file flats on the round shank to fit the lathe chuck key sockets. For large chucks, weld to the shank a piece that has been made to fit.

SMALL DRILLS when broken are often discarded. Here is an effective way to salvage them. Take a piece of small tubing, center the drill in it, and with the shank end inserted in the tube to a depth of ½ to ¾ in., pour hard high-speed babbitt around the shank. The tube should be heated before pouring the babbitt.





WORN PLIER JAWS make excellent vise grips. Cut the jaws from the pliers and file or mill the backs flat. Rods that normally slip in a vise can be held firmly.

Feeder Plants Ta

"Little Consolidateds", set up in small communities, attract people who would otherwise be left out of the war production

A NEW APPROACH to the manpower problem, created by the vast growth of war industries and by the demand for men in the armed forces, has been put into effect by the San Diego division, Consolidated Vultee Aircraft Corporation. The basis of the plan is to set up company operated feeder plants in small communities heretofore untouched by war industries. Sites for the plants are selected so they will not interfere with the supply of farm labor.

In two years San Diego has grown from a city of 150,000 persons to 350,000. The mushroom growth has taxed housing, food and transportation facilities which limits any further increase in population.

The company has already employed the services of independent subcontractors wherever possible. On the four-

Harnesses are assembled over pegs on a board. This feeder plant supplies 80 percent of the electrical harnesses used at San Diego

Two of the Laguna Beach operators work on a sleeve machine in preparing electrical harnesses for *Liberators*, *Catalinas* and *Corandos*

Tap New Sources of Manpower

engine bomber *Liberator,* parts are supplied by more than 2100 major subcontractors in 28 states and Canada.

The feeder plant plan does two things: it taps a source of manpower heretofore unused, and it keeps supervision in the hands of the parent company. Having determined a suitable location for the plant the next step was to rent existing buildings and install the needed equipment. All equipment, material, tools and gages are supplied by the parent company. Since the feeder plants are within 150 miles of San Diego, materials are supplied and finished parts are returned by truck. So far all supervision has been furnished by the parent plant, but it is part of the plan to develop local supervisors.

Feeder plants already established work on small electrical assemblies, control cables, Plexiglass parts, tube bending, covering and upholstering. Plants will soon be set up for work on metal bench work and the subassembly of small bulkheads.

Communities Welcome Plants

The feeder plants have been received with enthusiasm in the communities where they are located. Some of the employees, mothers with children of school age, are willing to work nearby but would not travel any great distance to take a place in war industry. Many other employees are attracted by the convenience of community operation who would not migrate to the already congested industrial areas.

The transference of work to the feeder plants has been made without any interruption in schedules. Five such plants are now in operation and the program calls for at least seven more.

The first of the feeders—to make 350 fabric parts which go into each *Liberator*—was opened at Santa Ana December 7 of last year with four employees; now it has about two hundred working in two shifts. The Laguna Beach plant was started December 28 to manufacture electrical harnesses for Consolidated planes with 18 employees; now it, too, has almost two hundred working two shifts.

A second shop at Santa Ana is devoted to tube bending. Another shop at Anaheim makes Plexiglass parts; still another shop at Banning manufactures control cables. Each of these shops is designed to make 80 percent of the parts needed at the parent plant.

Reversing the usual procedure, the work is brought to the workers in the feeder plants. Tools and supervision are furnished by the parent company

Foremen report that feeder plant groups operate at the same or better efficiency than those at the parent plants. Their small size permits greater personal attention by the supervisors than in the larger factories. Employees are cooperative; there is no "rest room" loafing.

Less than ten percent of the employees in all the feeder plants are women. In Laguna Beach, an art center, many are artists, writers, sculptors and "retired" men and women. Forty percent of the personnel at this plant have never worked before, but they are of an exceptionally high intelligence quotient and are doing a fine job.

All these shops operate exactly the same way as the San Diego plants. Employees wear buttons, punch time clocks and have rest periods. Before being hired all applicants must have birth certificates and physical examinations. But they do not have a transportation problem, and the food supply is much better than in San Diego and its environs.

Employees of William Sellers & Company who have been 100 percent on the job for the month receive a silver dollar, as a part of their regular pay. Since cartwheels are rare in Eastern cities, they are treasured as trophies or occasion favorable comment when spent

Absent Workers Help Hitler

Keeping workers consistently on the job has become a challenge to the ingenuity of plant management, and has resulted in the trial of a considerable variety of solutions

WITH THE DEADLY EFFECTIVENESS of Axis submarines attacking our ships at sea, time lost by workers in shipyards and war plants is cutting flow of war supplies to the battlefronts.

The incidence of absence among war workers is placed at 6 percent by a report of the War Manpower Commission. Based on a survey of eight large plants with 40,000 men and women on their payrolls, the report reveals more absenteeism among women than among men, and emphasizes that measures tending to improve morale are important in reducing the percentage of absentees.

Absenteeism usually is confined to comparatively small groups, averaging about 15 percent of the workers in a plant, the study discloses. The day after pay day is the worst for absentees, failure to report for work amounting to 50 percent of the total of employees in some cases.

What's the Cure?

No general panacea has been found for all types of absenteeism. Among the plans that have been tried by General Motors is the penalty layoff for excessive absences. Although people like to take time off at their own convenience, they dislike losing a day of work as a penalty. Hooky is fun, and the more time a man is scheduled to work, the more opportunity he has to play hooky. Penalty layoffs can be an effective disciplinary measure if discipline is needed, asserts A. T. Court of General Motor's labor economics section.

Taking the opposite view, C. G. Mitchell, assistant manager of service, Remington Arms Company, holds that penalties in the form of layoffs, for instance, are ineffective because the employee frequently welcomes a holi-

WHAT CAUSES ABSENTEEISM?

Experience of personnel managers has shown that certain basic causes underlie a large percentage of absenteeism:

Home responsibilities of women workers.

Imminence of being called to military service.

First experience with shift work.

Transportation difficulties and housing shortages.

Large pay checks and little opportunity to spend the money, both due to long working hours.

Independent attitude due to availability of plenty of other jobs.

Fatigue.

Boredom.

AND HOW HAS IT BEEN CURBED?

A variety of solutions have been offered. Each has a twist dictated by the local situation or the ingenuity of the management:

Penalties: enforced layoffs or recorded demerits.

Employee-aid in solving living, child-care, transportation or other personal problems.

Competitions between departments.

Follow-ups to homes of absentees to underscore importance of attendance and to learn reason for absence.

Closer personal relationships between foremen and employees, impressing upon the latter their important parts in the general production scheme.

day; moreover, a layoff leads him to believe that his services are not vital to the operation of the plant. Extra pay for perfect attendance has a stimulating effect at first, but the employee soon begins to regard it as a part of his regular earnings and becomes disgruntled when it must be withheld.

Mr. Mitchell believes that the problem of absenteeism must be met on an individual basis by foremen who use real leadership and salesmanship in their approach. Evidence that the foremen want to help them with their personal problems will do much to arouse that interest.

Foremen Reduce Absenteeism

At a Remington Arms plant an absenteeism-combating program is largely administered by foremen. The program was placed in operation by first establishing a uniform system of reporting absences and then by having each foreman talk to each of his subordinates, emphasizing the importance of the employee's job, his responsibilty to himself, his family and his country. Whether or not the worker had previously been absent, an attempt was made to impress upon him the serious effect absences could have.

Then the program proper was initiated. Thereunder, the foreman personally interviews each absentee upon his return to work, being careful to show a personal interest in the individual and a sincere desire to help him overcome the difficulty which is causing absence. As a guide for this interview, the foreman is provided with a list of possible questions.

Each foreman keeps a file of the attendance records of his group. These records show the complete history of all cases of absence.

A weekly department chart is kept, showing by shift the percentage of attendance.

Each month the shift supervisor and the foremen hold a conference on absenteeism. Specific problems are discussed and efforts made to develop corrective measures.

The chronic absentee is interviewed off the job by the foreman and the supervisor. Every effort is made to discover the source of his difficulties and to devise means of assisting him. If this fails and the employee is absent again, he is put on probation. Only after the most exhaustive efforts to help him is he subject to dismissal.

In three months, this plan reduced absenteeism without leave 50 percent.

A system of visiting men with bad attendance records and those who are out more than a day or two in succession, has been successful in General Motors plants. Several plants report that various sorts of rather low-pressure follow-ups are effective. For example, telegrams to absent workers, a red notice in the clock rack when the man returns, telling him to report to his foreman for his card, and "Nazi money" in the pay envelope to cover personal lost time have all been tried.

Another procedure consists of having persons returning from unexcused absences fill out a more or less onerous

To cut absenteeism among its 3,000 women employees N. A. Woodworth Company has established a modern luxurious beauty parlor in the plant for their convenience. Perfect attendance wins prizes in beauty parlor credits

questionnaire. This is designed partly as a penalty and partly in an attempt to get some information concerning the individual's situation and reasons for absence.

Revere Copper and Brass combats absenteeism due to illness by a series of steps, reports C. S. Phillips, personnel director. Employees are given thorough annual physical examinations; if any condition which might cause future illness is discovered, the individual is told about it and referred to his family physician. Periodic checks are made to see that he is receiving proper care.

Revere's medical program has been extended to insure that minor illnesses reported in the first aid department receive greater attention. This reduces absenteeism.

Workers Need Rest

Proper recreation is encouraged, though full employment plus overtime leaves little opportunity. Bowling teams from each shift have become popular and competition goes on throughout the day and evening.

Long hours and seven-day workweeks have been found to increase absenteeism. According to the British Research Council, Washington officials and the experience in General Motors plants, six days of work is the optimum in any seven-day period. A seven-day schedule, in one section, resulted in such an increase in absenteeism, that about 40 percent of the additional scheduled time was lost by comparison with another section working six days. The number of days worked per week are more important than the hours. Six ten-hour days is frequently possible without serious loss in attendance or reduction in efficiency.

Keeping a public record of the individual's absence encourages the group to bring pressure on him if he falls behind too much. "Missing from Action" lists have been suggested.

William Sellers & Company rewards workers who have been 100 percent on the job for a month by inclosing in the pay envelope of each a silver dollar attached to a card annonucing his membership in the "Sellers 100 Percent Club." The silver dollar is intended as a trophy signifying the employee's perfection; the employee who receives five silver dollars will also receive a substantial cash award in addition to his regular pay. Newspaper advertising advises the public of the significance of the silver dollars.

A cash drawing plan for rewarding employees having perfect time card records, was instituted at the San Diego plants of Consolidated Vultee Aircraft Corporation, and man-hours saved by regular attendance during the first four-week period were enough to produce 6½ Liberator B-24 bombers, Harry Woodhead, president, has announced.

Under the plan, all workers having perfect time cards are eligible to participate in cash drawings. Prizes total $10,000 monthly. An additional $5,000 in prizes is distributed quarterly among employees who qualified for three successive monthly drawings. Prizes are divided so that each qualified worker receives one, varying in the first drawing from 2 of $1,000 each, to 80 of $25 each.

"The Pearl Harbor Vengeance Legion," formed at the Westinghouse Lamp Division admits to membership only those workers who achieve a perfect attendance record over a 12-month period. Every member is given a card stating that he has been elected by the Labor-Management Committee for his patriotic devotion to duty exemplified in not being late or absent from work for one year. On the back of the card is the pledge of allegiance to the flag, to be signed by the newly elected member.

Beauty Shop Aids Attendance

Stating that "Extensive research has revealed that many of our young ladies in working seven days a week find it impossible to secure those personal items and treatments which become a necessity to every American woman," N. A. Woodworth, president of the company bearing his name, explained the recent opening in the plant of a completely equipped and luxuriously furnished beauty parlor, cosmetic canteens and powder-room facilities. For 30 days the beauty shop will operate from 8:30 to 9 p.m. each day, but eventually will be open around-the-clock.

The Woodworth Company's beauty salon will service women employees by appointment before and after work shifts. To further encourage good attendance, the company has established a series of prizes for women workers, based on unbroken attendance records for six-, eight-, ten-, and twelve-week periods with the prizes increasing in dollar value as each subsequent two-week period is completed.

Tie-in With Promotions

An important approach to the problem is through emphasizing the attendance record in connection with any discussion of promotion, transfer, assignment of desirable work, settlements of grievances, or other points at issue between the employer and the employee. Individual attendance histories are essential in making the employee realize that steady work is an important factor in getting ahead with the company—that absence doesn't make the heart grow fonder.

Award pins or certificates may be presented for good attendance records. Departmental contests also offer possiblities, and it has been suggested that individual products (if of sufficient size) be named for workers with good attendance records.

If many of the workers are mothers with young children, establishment of day nurseries will help.

The War Labor Board recently made part of the wage increase awarded copper workers contingent upon the individual attendance and production records.

Posters Play a Part

Posters and other displays, emphasizing the importance to the war production effort of regular attendance are frequently used and take a variety of forms. American Car & Foundry Company has a sign over the clock house of its Buffalo plant, "Today there are — employees absent. Work for America; don't loaf for the Axis!"

American Screw Company places posters in each department, into which are inserted daily the number of workers absent from that department as well as from the entire plant, and the loss in production of screws represented thereby.

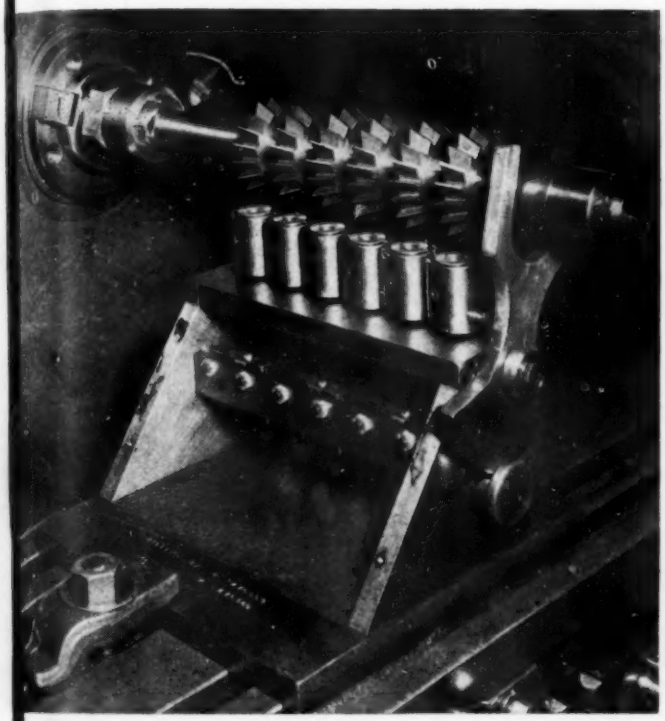
Some companies award daily or weekly plaques to the department having the highest percentage of attendance, and booby prize plaques to those with the lowest.

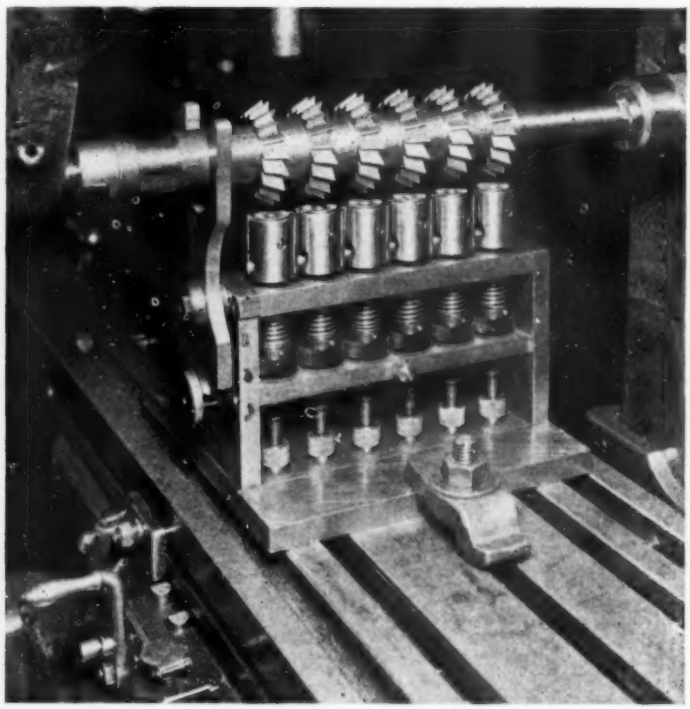
Other companies have bonds and stamps as prizes to employees of the department with the highest percentage of perfect attendance for a period.

The problem of absenteeism has as many facets as there are workers, as many aspects as there are factories. No one plan is going to solve all cases. However, a careful consideration of the problem and of the solutions that have proved successful will provide a basis from which to work.

Dividing Head Replaced By Automatic Indexing Fixture

BY G. F. GROSCHKE and R. J. THIMINEUR, GENERAL ELECTRIC COMPANY





This fixture indexes automatically during the machining of 68 teeth on each of six clutch knobs. Only one knob at a time could be machined with a standard dividing head. Production jumped from 2 to 20 knobs an hour

IN ORDER to machine 68 face teeth on a clutch and meshing knob, the established practice was to machine one knob at a time in a standard dividing head on a suitable milling machine. The knob was mounted on a stub arbor, held in place by a brass setscrew, and the assembly inserted in the faceplate of the dividing head. The brass screw was scrapped after machining the knob. Production by this method was two pieces an hour.

Circumstances demanded that the parts be produced more quickly, which presented the problem of increasing machine utilization. This was accomplished by the illustrated multiple automatic indexing fixture, wherein six knobs are machined at one time. Production increased to 20 pieces an hour. Because of a $1\frac{3}{4}$-deg. offset required on the knob teeth, it was considered and found practical to adapt the fixture for cutting during the forward and return movement of the machine table.

The knobs are inserted in six expansion sleeves and are held securely in place by tightening socket-head screws. Each expansion sleeve is fitted to a spindle bushed in three horizontal plates. The ends of the spindles at the baseplate are threaded for heigth adjustment by knurled nuts, the faces of which are finished parallel to the baseplate. Therefore, the spindles serve as jacks to bring each knob to the same height under its respective cutter, compensating for variation in cutter diameter and length of knobs. Stock size 60-deg. angle cutters are used.

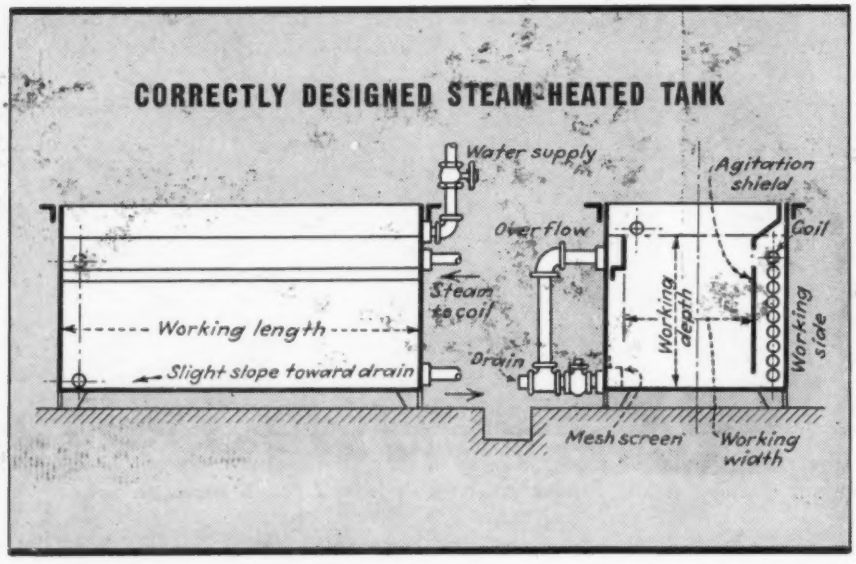
Indexing is accomplished by six double-action pawls that mesh with six ratchet wheels, each of which is fitted to one of the spindles and has 68 teeth, the same number of teeth required on the knobs. The pawls are actuated by a spring-loaded slide bar that is pulled out at the end of the table travel by a U-shaped lever pivoted on the fixture and slidably fitted as a yoke to the milling machine arbor. The flat cam surface at the lower end of the lever actuates the slide bar by contacting a large washer on the slide-bar extension, thus providing endwise movement as the lever oscillates.

Compression springs between the machined shoulders of the ratchet wheels and the underside of the horizontal top plate of the fixture maintain the expansion sleeves and inserted knobs at proper height for machining. Spring action holds the spindles tight against the bottom plate at whatever height is set by the knurled nuts.

SIMPLE CLEANING TANKS
for small-lot metal washing

BY DR. R. W. MITCHELL, TECHNICAL DIRECTOR, AND MARCEL T. ZINTY, CHIEF ENGINEER, MACHINE DIVISION, MAGNUS CHEMICAL COMPANY

This is the third article in a series on the selection of metal-washing materials, methods and machines. More complicated high-production machines will be discussed and illustrated in an early issue



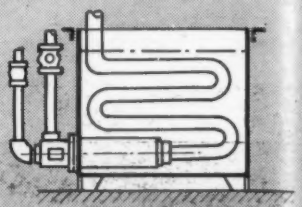
Other methods of heating, agitation and drainage can be used. A cover may be needed to keep the solution clean and, where heat losses are important, the tank may be insulated

STILL TANKS, which are the simplest metal washing devices, are adequate for many small-scale cleaning jobs. They are usually made of steel, but pickling tanks and those which are to contain acid solutions may be made of wood, rubber- or lead-lined steel, stoneware, cement, vitreous enamelled iron, monel metal, or other material resistant to the solution to be stored.

A correctly designed tank should provide sufficient capacity to handle the work without crowding. When the tank is too small, dirt will accumulate and reduce the effectiveness of the cleaning solution. Therefore, the tank should be deep enough to allow dirt to settle out well away from the cleaning zone. Deep tanks also allow the solution to be agitated without danger of uncovering the work.

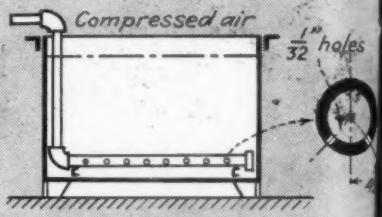
The bottoms of all tanks should have a definite pitch and, on large tanks, a sump to catch muck is desirable. The lower side of the tank bottom should be opposite the heating coil or burner. An adequate drainage system should be provided, the drain being placed at the lowest point so that all muck can be flushed out. However, if the muck deposit is heavy or the piping is of insufficient capacity, it is best to locate the

METHODS OF AGITATING SOLUTIONS



IMMERSED GAS BURNER AND COIL

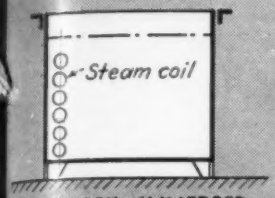
METHODS OF HEATING SOLUTIONS



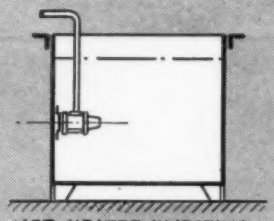
AGITATION BY COMPRESSED AIR

TANK DAMS OR SKIMMING TROUGHS

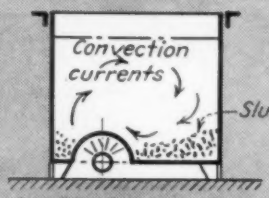
CLEANING AND VENTILATING TANKS



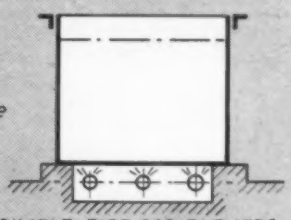
STEAM COIL IMMERSED IN THE SOLUTION



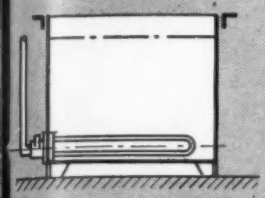
JET HEATER INJECTING LIVE STEAM



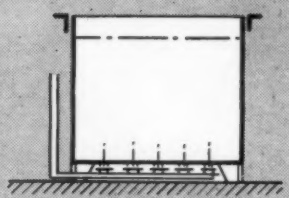
GAS BURNER IN CONVEX CHAMBER OFF CENTER



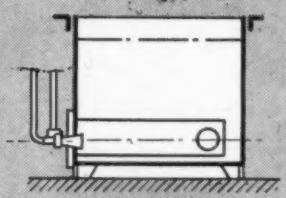
SIMPLE PIPE GAS BURNERS



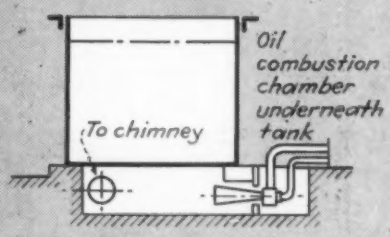
RESISTANCE HEATERS IMMERSED IN THE SOLUTION

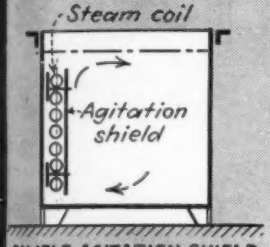


STRIP ELECTRIC HEATERS BELOW BOTTOM OF TANK

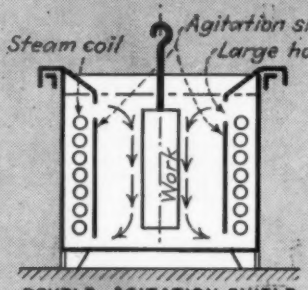


OIL BURNER CHAMBER IMMERSED IN THE SOLUTION

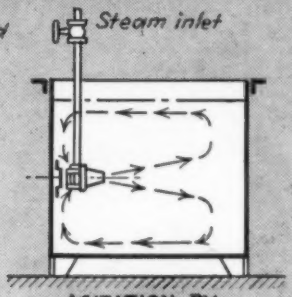




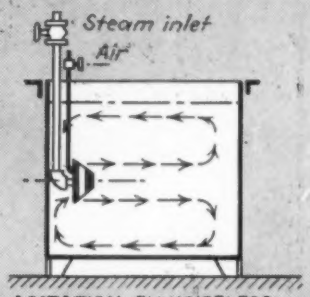
SIMPLE AGITATION SHIELD



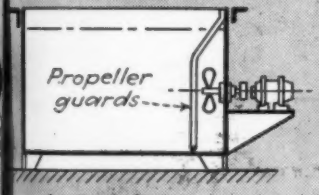
DOUBLE AGITATION SHIELD WITH EBULLITION PORTS



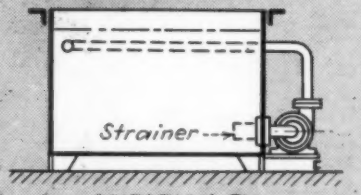
AGITATION BY STEAM JET HEATER



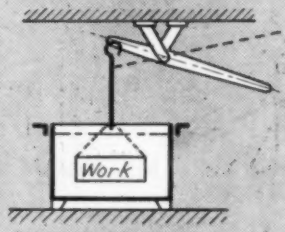
AGITATION BY NOISELESS CIRCULATOR HEATER



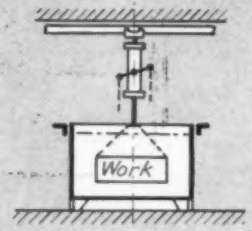
AGITATION BY SMALL PROPELLER



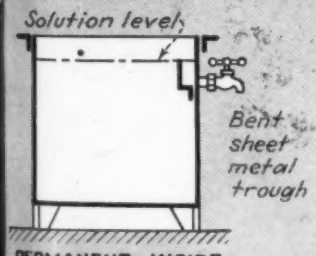
AGITATION BY CENTRIFUGAL PUMP



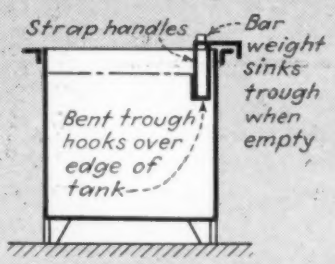
SIMPLE AGITATION BY HAND



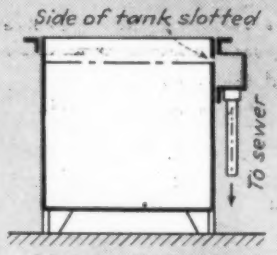
MECHANICAL AGITATION BY AIR HOIST



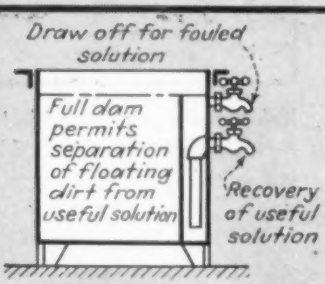
PERMANENT INSIDE SKIMMING TROUGH

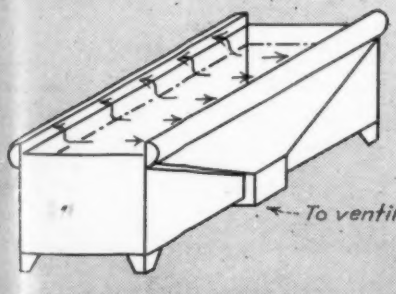


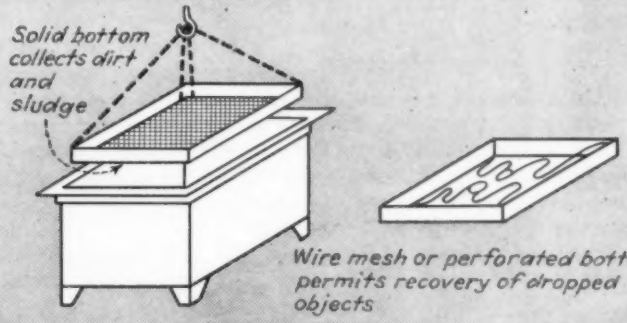
REMOVABLE SKIMMING TROUGH



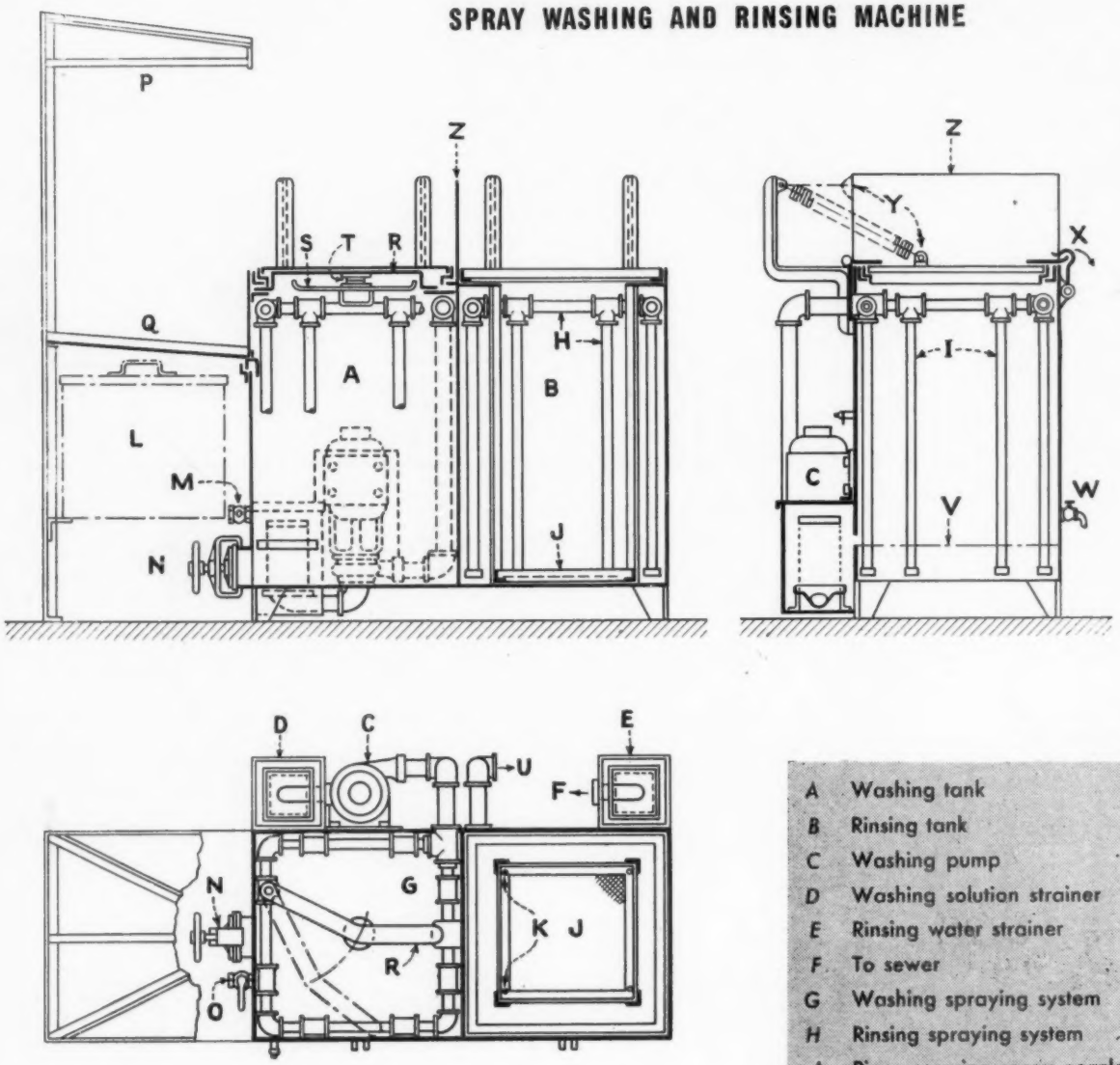
DAM OUTSIDE WORK AREA


Draw off for fouled solution
Full dam permits separation of floating dirt from useful solution
Recovery of useful solution





SPRAY WASHING AND RINSING MACHINE



A	Washing tank
B	Rinsing tank
C	Washing pump
D	Washing solution strainer
E	Rinsing water strainer
F	To sewer
G	Washing spraying system
H	Rinsing spraying system
I	Pipes carrying spray nozzles
J	False bottom
K	Lifting chain
L	Solvent storage tank
M	Supply valve
N	Cleaning port
O	Draining valve
P	Work hanger
Q	Drip pan
R	Bracket for holding work
S	Revolving hanger
T	Ball-bearing swivel
U	To city water or pump
V	Solution level when operating
W	Gage cock
X	Safety device
Y	Cover-lifting device
Z	Partition between tanks

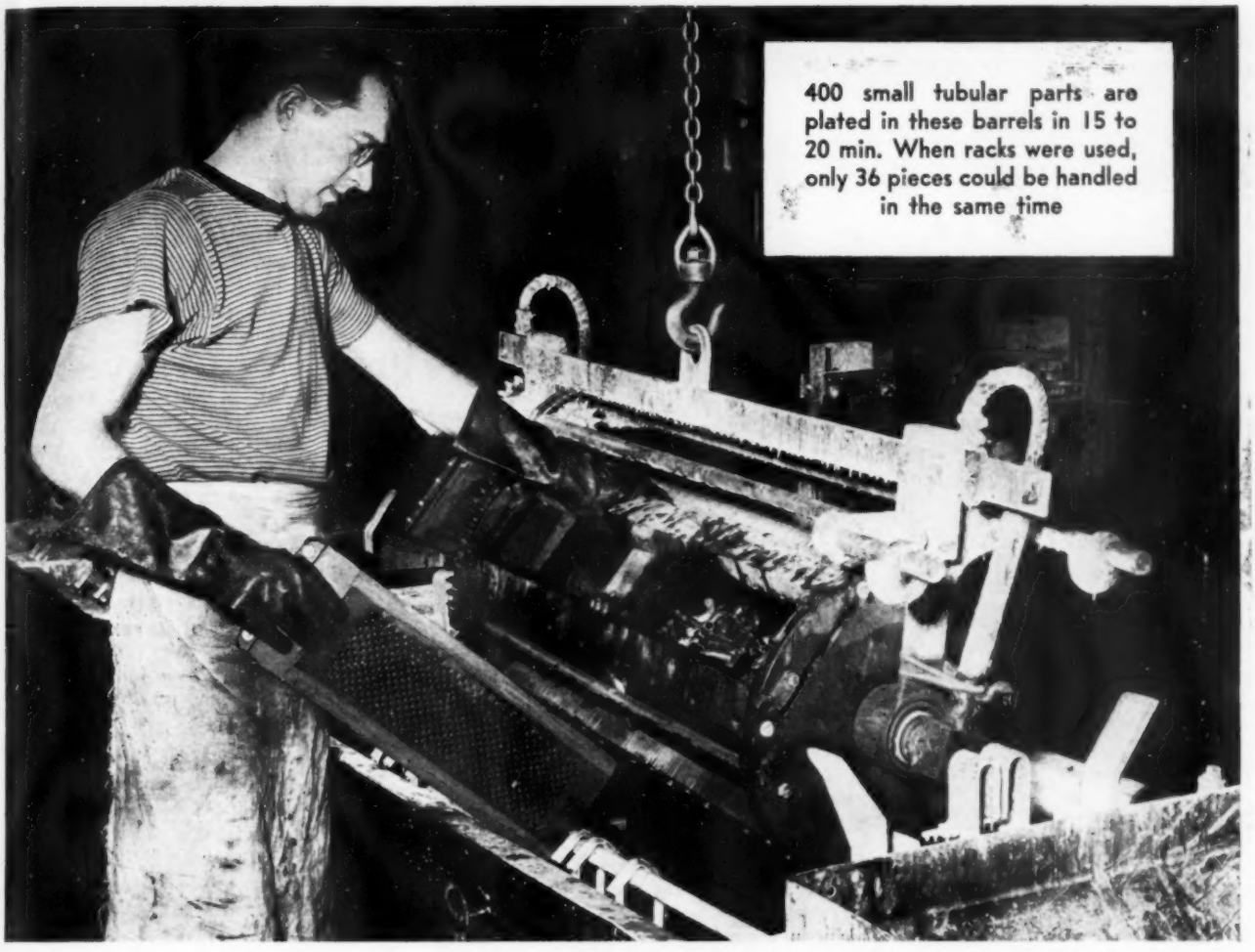
Refinements can be added to a still tank until it evolves into a complicated metal-washing machine. Here, such features as pump circulation and spraying, a swinging bracket to hold the work, a cover and cover-raising device have been added to make the transformation

draw-off several inches above the bottom of the tank. The solution can then be run off above the muck level and the muck itself be dug out.

Simple Emulsifiable Solvent Machine

A machine which is intermediate between simple tanks and elaborate machines is illustrated in the accompanying diagram. This machine provides a simple, economical means of making effective use of emulsifiable cleaners.

The unit consists of two covered tanks equipped with spray nozzles which insure thorough wetting and penetration by both the cleaning solution and the pressure rinse. No heating coils are provided since the emusifiable cleaner works at room temperatures. Work is suspended on a ball-bearing swivel from a revolving hanger bracketed over the tank. As the sprays hit the work, the bracket revolves, insuring that all surfaces are covered during both washing and rinsing. The unit is applicable to a great variety of work on a moderate scale.



400 small tubular parts are plated in these barrels in 15 to 20 min. When racks were used, only 36 pieces could be handled in the same time

Buick Improves Plating Practices

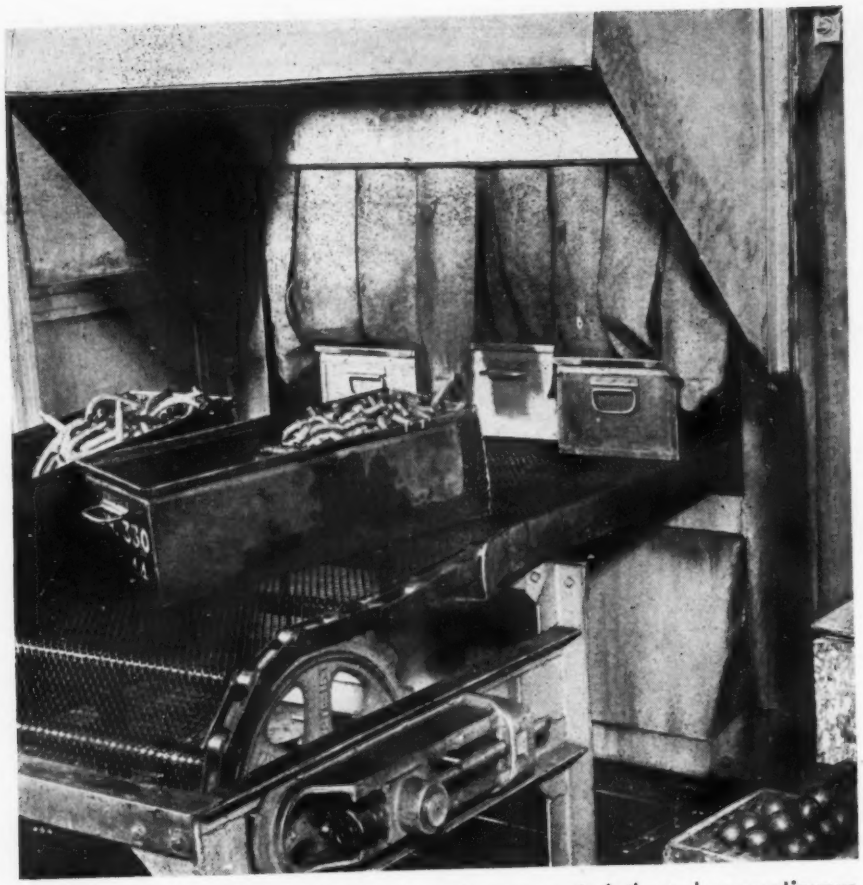
BY HERBERT CHASE

NEW APPROACHES to standard practices are usually productive of new and better methods of doing the job. This is apparent in the plating routines developed to protect the vital parts of the Pratt & Whitney aircraft engine now manufactured at the Melrose Park plant of the Buick division of General Motors. Since aircraft engine parts must be preserved from corrosion in transit and service, they are given a thin coating of protective metal before assembly. This has been standard practice for years. At Melrose Park, however, some new methods have been developed which turn out large quantities of precise parts at a high production rate.

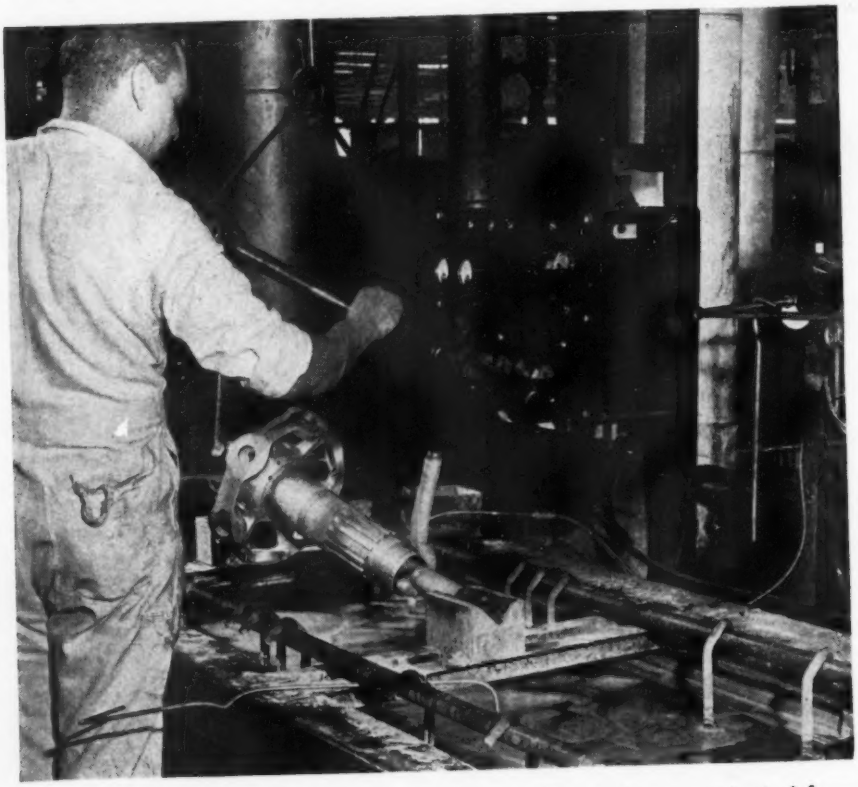
One example of faster production is found in the methods employed in cadmium plating S-shaped tubular steel parts about ½ in. in diameter and 4 in. long. Formerly these parts were plated on racks holding 36 pieces. Four racks could be handled in 15 to 20 min. during which 0.0005 to 0.0007 in. of cadmium was applied. Now, by barrel plating, 400 parts are given a coating of the same thickness in the same time. The complete plating cycle is as follows:

Two wire baskets, each loaded with 200 parts are lowered into a vapor-degreasing tank of trichlorethylene for solvent cleaning and then are transferred by an overhead track hoist to a proprietary alkaline cleaner maintained at 200 to 212 F. Here the work is first made the cathode for 3 min. and then the anode for a few seconds. After rinsing in cold water, the baskets of parts are given a 4- to 5-sec. dip in a 50 percent muriatic acid solution and are again cold rinsed. After a few seconds dip in a 1 percent solution of sulphuric acid and another cold rinse, the parts are ready for plating.

For plating, the baskets are emptied into a two-compartment plating barrel having two danglers and are lowered into the plating tank. This contains a conventional solution of cadmium cyanide operated under a 30-amp. current at room temperature. Ball anodes are suspended along each side of tank and plating is effected in 15 to 20 min. The barrel is then lifted by a hoist and, after draining, the load is discharged through hoppers into two baskets submerged in water. After another cold



Tote boxes containing small plated parts are carried through a continuous baking oven on a wire-mesh belt. Parts are dried for one hour at 290 F.



Precision-machined surfaces on an aircraft propeller shaft are protected from marring while being plated by suspension on special soft copper bars which rest in V-blocks during immersion

water rinse, the loads are given a 20- to 40-sec. dip in a Udylite chromic-acid-chromic-sulphate solution at room temperature and are again cold rinsed. This is followed by a dip in a soft soap solution to neutralize the acid, a hot rinse, and drying in a centrifugal dryer.

As the plating does not throw into the inside of the tube, the parts are dipped in Rustban oil, are drained and then emptied into tote boxes which are passed through a continuous baking oven held at 290 F. Boxes are advanced on a wire-mesh belt and remain in the oven for one hour, after which they are ready for delivery to the bond room for distribution to assembly lines.

The propeller shaft, which is one of the major steel forgings required in each engine, comes to the plating department completely machined to receive a 0.0001-in. coat of tin. Great care must be used in handling this part, as it involves a great amount of high-precision machine work and must not be marred. The part is handled on a soft copper bar electrode which is passed through the bore and is supported by copper links from a copper busbar. This assembly is lifted by a spring-balanced hoist mounted on a monorail over the cleaning and plating tanks.

After loading, the part is lifted and lowered into a vapor trichlorethylene tank where, besides being subjected to the vapor, it is sprayed with liquid solvent. After this cleaning, the part is transferred to a mild alkaline cleaner which is heated to 200 to 212 F. In this solution the part is first made the cathode for 3 min. and then the anode for a few seconds. This is followed by cold rinsing and 4- to 5-sec. dip in a 50 percent muriatic acid solution and another rinsing. The plating bath is a standard sodium stanate solution and is held at 150 F. The 0.0001-in. coating is applied in 3 to 4 min. at 4- to 6-volt potential and 50-amp. current.

After plating, the shaft is rinsed, first in cold and then in hot water, after which it is blown dry with an air jet. As a final operation the part is coated with Rustban and allowed to drain. No baking follows the oiling operation in the case of this part.

No More Stockrooms

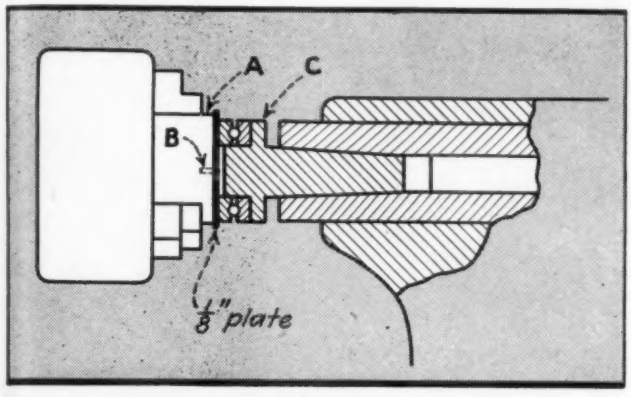
One aircraft company has simplified its storage problem and reduced material handling by eliminating the stockroom and putting inspected parts in bins directly on the assembly line. The bins provide an excellent place for the accumulation of work and dispense with the steps of checking in and out of a stockroom.

IDEAS FROM PRACTICAL MEN

Thrust-Bearing for Machining Plates

BY WALTER KARPUSIEWICZ

Difficulty was recently experienced in turning down $\frac{1}{8}$-in. thick stainless steel plates. The 2-in. outside diameter had to be concentric with a $\frac{1}{8}$-in. hole drilled and reamed in the center. The problem was solved by chucking arbor *A* in the lathe, and centering the plate thereon by a locating pin *B* that fitted the reamed hole in the plate. Pressure was applied against the plate by thrust-bearing tailstock adapter *C*. Pressure applied through the tailstock handwheel proved enough to prevent the work from slipping.

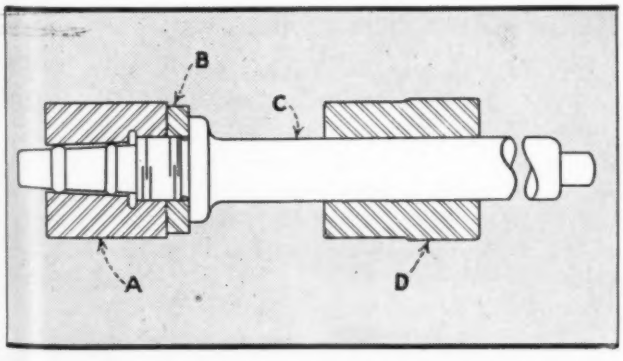


Thin stainless steel plates were turned concentric with a center hole while holding pressure was applied with this thrust-bearing tailstock adapter

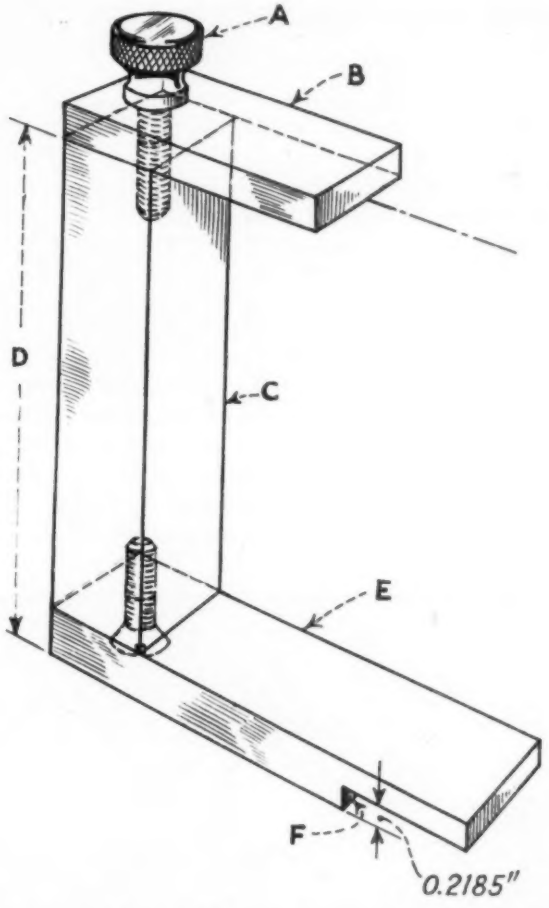
Reamer Sizes Holes In Restricted Locations

BY HENRY BERNADT

The illustrated tool is essentially an expansion reamer for finishing holes in restricted places. When it is set up for production, the unit is first taken apart and reamer *A* is inserted in the hole to be finished. The reamer is tightened against washer *B* by a twist of arbor *C*. This expands the tool to the proper diameter and reams the hole to the correct size in one turn. Part *D* is a guide member. Cutter wear is taken up by decreasing the thickness of washer *B*. This permits the taper portion of the arbor to further enter the cutter. A 0.001 in. reduction of washer thickness will expand the reamer 0.0001 in. The tool is being used in General Electric's Schenectady works.



The cutter of this tool is inserted in the hole to be finished. The arbor is then applied and turned to expand the cutter and ream the hole



The horizontal bar of this tool, when mounted on the lathe ways, provides a surface against which to set the toolbit in line with the centers

Tools Set Quickly in Line With Lathe Centers

BY D. O. WESTBROOK

When machining tapers or cutting threads, the cutting edge of the tool should coincide with the lathe centers. The setting of the tool in line with the centers can be done quickly and accurately with the aid of the device shown in the drawing. It is set on the ways, knurled screw *A* is loosened, and horizontal bar *B* is turned to a convenient position and then tightened. The toolbit is brought under

the horizontal bar with the crossfeed and compound rest. The toolpost screw is loosened, the toolbit holder tilted until the cutting edge touches the under side of horizontal bar *B*, and the toolpost screw tightened to hold the toolbit in the set location.

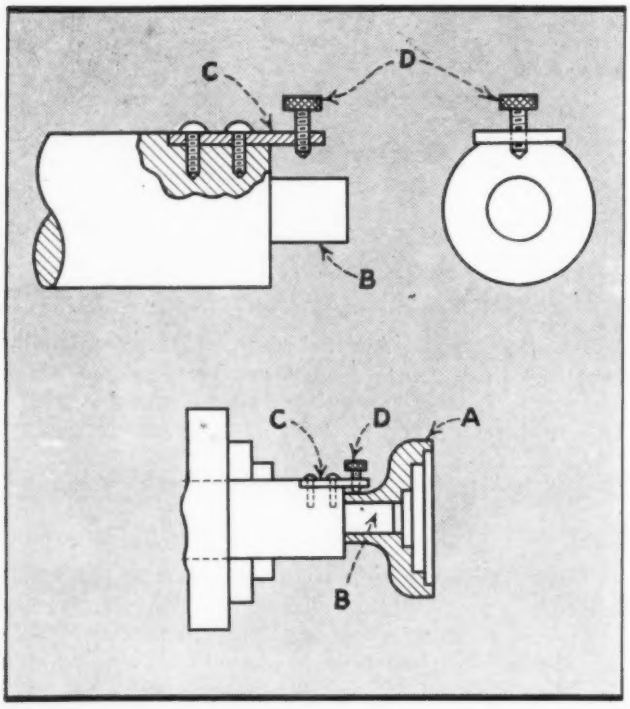
This setting tool can invariably be used without disturbing the work. In unusual cases where it is desired for any reason to invert the cutting edge of the toolbit, the cutting edge can be set to the top of post *C*. Height *D* must be maintained accurately, according to the dimensions of the lathe on which the tool is to be used. Parts *B*, *C*, and *E* of the tool must be ground to maintain the established height. Step *F* in base *E* is not necessary when the tool is used on lathes having flat ways.

Locator Clamp Holds Parts for Light Cuts

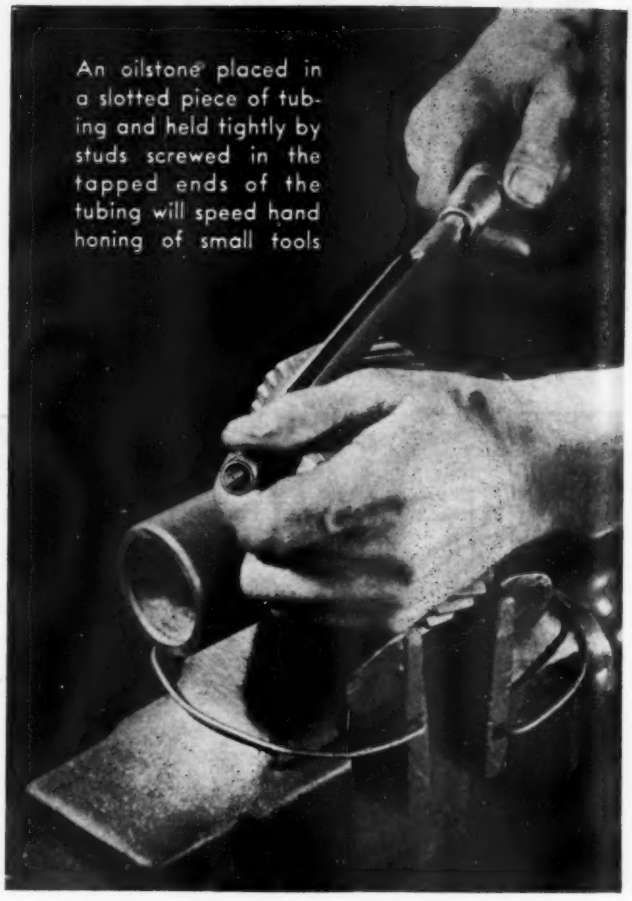
BY EARL J. BREEDING

On a recent job, it was necessary to re-machine a number of small castings *A* which were not uniform on the over-all length. This prevented clamping by ordinary methods for turning the part to required length in a turret lathe. Therefore, the illustrated arbor clamp was designed as a combination work holder and locator, so that stops could be set when doing the work in the turret lathe.

The casting, having a close tolerance bore, was mounted on arbor *B* to which was bolted a short length of flat strap steel *C*. Casting *A* was then positioned on the arbor from the turret and clamp screw *D* tightened, thus placing the casting at a uniform distance from the turret. Obviously, the arbor clamp can be used only on light cuts. However, it has been used successfully on the the job described, as well as for a second operation on another job, and reclaiming additional pieces that were machined off center.



Castings can be located accurately and held tight enough by this arbor clamp for light cuts on a turret lathe



An oilstone placed in a slotted piece of tubing and held tightly by studs screwed in the tapped ends of the tubing will speed hand honing of small tools

Oilstone Holder Made From Tubing

It is frequently necessary to hone dies, cutting tools and even the inside splines on heat-treated gears with a hand oilstone. A holder for such stones, if suitably designed, will minimize breakage, speed production, and diminish operator fatigue. One such holder is shown in the illustration.

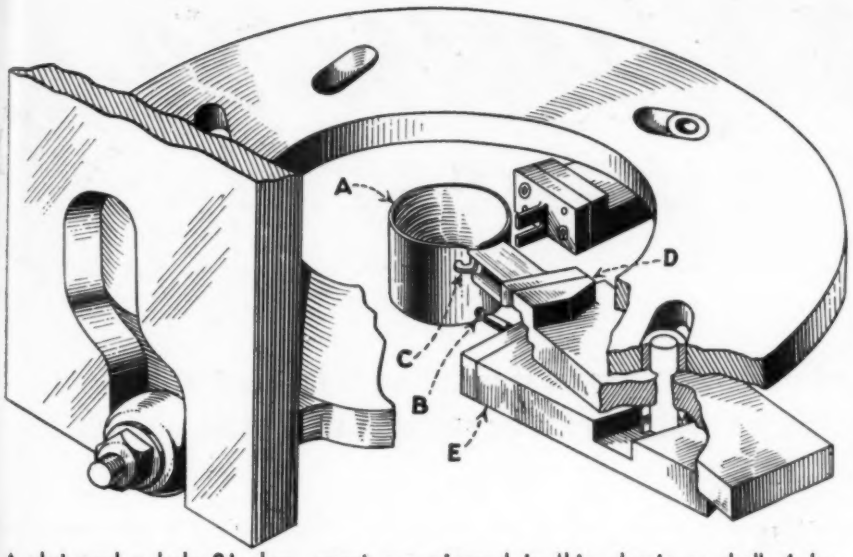
The center of the tubing is cut out to fit, in this case, an oilstone $\frac{3}{8}$-in. square and $6\frac{1}{2}$-in. long. One end is tapped to take a hexagonal head stud, while the other end is tapped to take a piece of threaded stock with a tang to fit a file handle. When the oilstone is placed in the slot, it can be held tightly by adjusting the stud and threaded handle.

Multiple-Slide Piercing Die

BY E. H. GIRARDOT and F. S. MARCHEWKA
General Electric Company

An unusual problem was presented in planning and designing a die for piercing aluminum shell *A*, which calls for two 0.098 in. diameter holes, three slots and three notches. Production requirements on this shell were exceptionally high, making it desirable to pierce the shell complete in one operation in order to secure maximum accuracy, low cost, and full utilization of machine equipment.

A multiple-slide die with individual slides driven radially by a ring cam would have provided an economical method except for the difficulty presented by the center lines of one 0.098 in. hole *B* and the locking slots *C*, which are only 21 deg. from each other. This prevented the mounting



A slot and a hole 21 deg. apart are pierced in thin aluminum shell *A* by operating a dual slide radially from a single location on a ring cam

of these punches in one slide, while insufficient space was available for inserting two individual slides at their proper angle.

This problem was solved as shown in the drawing by mounting two slides *D* and *E* one on top of the other with each carrying its punch to the proper angle. The lower slide is actuated by the motion of the upper slide, which in turn is driven by the ring cam operating all the slides.

Steel-Rule Graduations Made in the Lathe

BY W. W. QUIST

The engine lathe offers a practical means of marking the linear divisions or graduations on flat or round scales. Short scales which need not be very accurate may be graduated by setting the compound rest parallel to the ways and laying off the divisions by setting the graduated feed dial. However, a more accurate method and one which makes possible the marking of long scales employs the leadscrew.

The lathe is arranged to cut the number of threads per inch which corresponds to the desired number of graduations per inch or suitable factor thereof. It is evident that, with the split nuts engaged, for each revolution of the spindle the carriage will advance a distance equal to the pitch for which the lathe is geared. By dividing the revolutions of the spindle it is possible to increase the number of divisions available; that is, a lathe set for 13 threads per inch will produce 39 divisions per inch if the revolution of the spindle is divided into three equal parts. The jaws and slots of the various chucks and faceplates are useful in securing whole or partial revolutions of spindle. A soft metal stop between the ways and jaws or stops provides an accurate means of indexing. Each graduation is made after the carriage has been advanced the correct distance.

Round scales may be mounted between centers, held with a dog, and turned the desired part of a revolution to produce a suitable mark. In some instances it may be desirable to hold the part in the chuck, in which case the leadscrew must be disengaged after indexing so the graduations will be perpendicular to the axis of the rod. After marking, which is done by turning the chuck, the spindle must be revolved back to the position at which the leadscrew was disengaged and the split nuts again closed for indexing the next space.

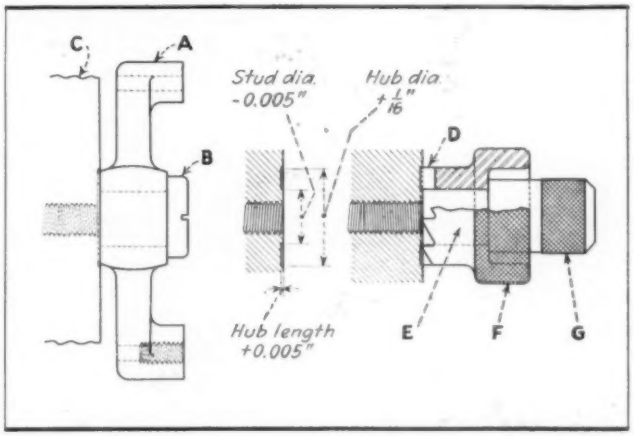
Flat scales must be mounted in a suitable fixture and held rigidly in a horizontal position. The design of the fixture, which may be mounted between centers, in or on the tailstock spindle, or on the ways of the lathe, will vary with the size of scale to be graduated and the ingenuity of the operator. The length of the graduations are regulated by the distance the tool is advanced by means of the cross-feed. A toolbit similar to a threading tool is suitable for marking round scales. Special tools must be devised for graduating flat scales.

Undercutting Tool for Handwheel Assembly

BY CHARLES HATTENBERGER

The illustrated cutter was used to expedite the assembly of bellcrank *A* hung from stud *B* screwed into base *C* of a special machine, a large number of which were being manufactured. The hub of such bellcranks, and handwheels on other machines, to be assembled frequently are machined a few thousandths long. Consequently a certain amount of hand fitting is required, or the head the of the stud must be faced to produce more length clearance.

To reduce fitting time to a minimum, the illustrated tool



A two-bladed cutter can be used to undercut machine bases for assembly of bellcranks or handwheels, the hubs of which have been machined too long

will produce an undercut on the base of the machine to receive the oversize length of the bellcrank hub. Cutter *D*, which is free to rotate on hardened spindle *E*, is turned by knurled knob *F*. Spindle *E* is threaded into the machine base and tightened as needed to provide feed. If desired, a handle can be attached to knobs *F* and *G*.

War Winning SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

Redesigned Tip Speeds Flame Cutting

A standard Airco torch tip, style 139, No. 2 size, can be changed as shown in Fig. 1 to facilitate the flame cutting of plates. File the standard tip until the projecting fin is the same width as the oxygen blowhole, and place the tip in the torch with the filed fin parallel to the torch pipes as shown in Fig. 2 and with the preheat hole adjacent to the handle. The latter is important, because an offset in the fin will lead the torch off the line while making the cut, thus resulting in ragged edges on the plates.

Start the cut in the usual manner, that is, make a ¼-in. hole in the plate, rest the torch pipes in one hand, and draw the torch toward the body. The projecting fin filed on the torch tip will rest in the hole and along the sides of the cut as the work proceeds. This will hold the torch in line, whether the work be downhand, vertical or overhead as shown in Figs. 2, 3 and 4, respectively. The tip shown in the illustration works best for cutting ⅜-in. plate. If the projecting fin tends to wobble from side to side of the groove, the flame is too hot, the tip is dirty, or the fin is too narrow. Should the tip stick to the sides of the groove, the fin is too wide, or the flame is too cold. *Suggested by G. K. Dieffenbacher, Bethlehem Steel Company.*

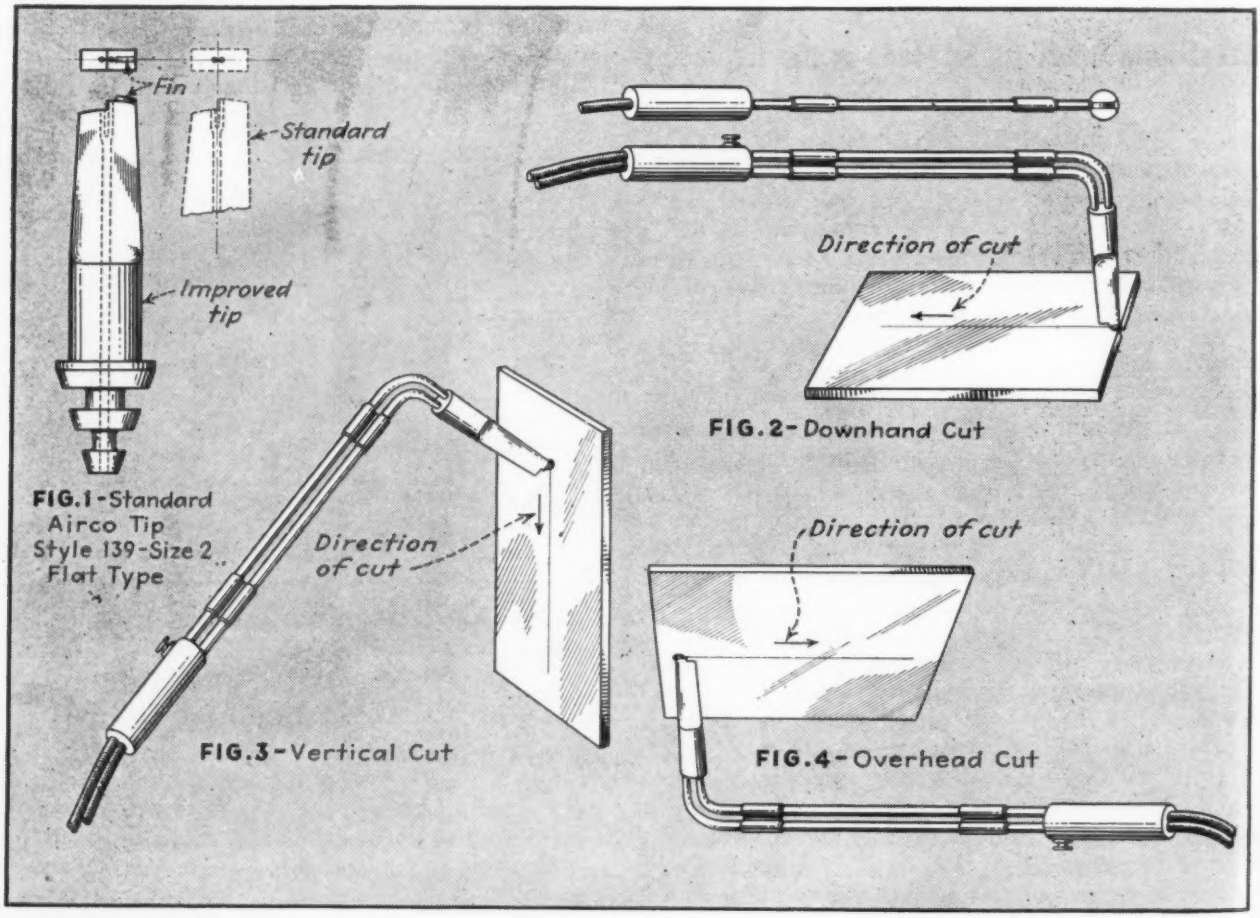
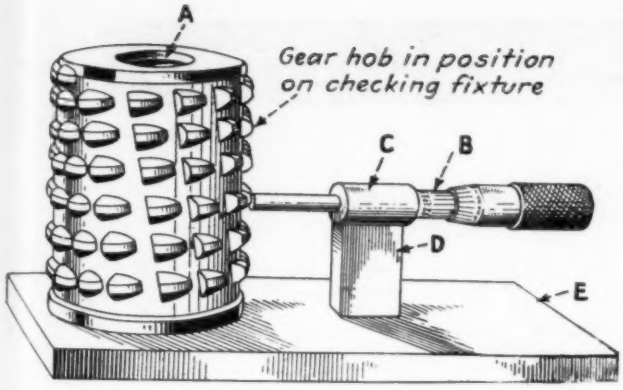


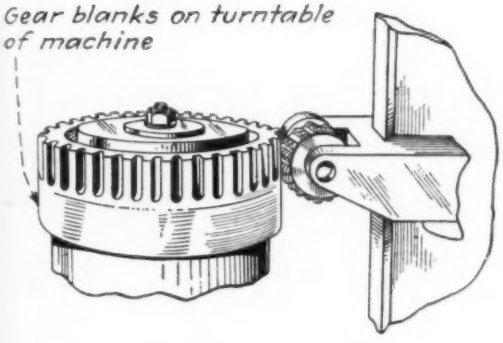
FIG. 1 - Standard Airco Tip Style 139-Size 2 Flat Type

FIG. 2 - Downhand Cut

FIG. 3 - Vertical Cut

FIG. 4 - Overhead Cut





screw end *A* is inserted in the bolt-head slot, and the nut tightened by rotating handle *C*, making the job a simple two-hand operation. *Suggested by Harold Glider, Sterling Engine Company.*

Checking Fixture Decreases Hob Set-Up Time

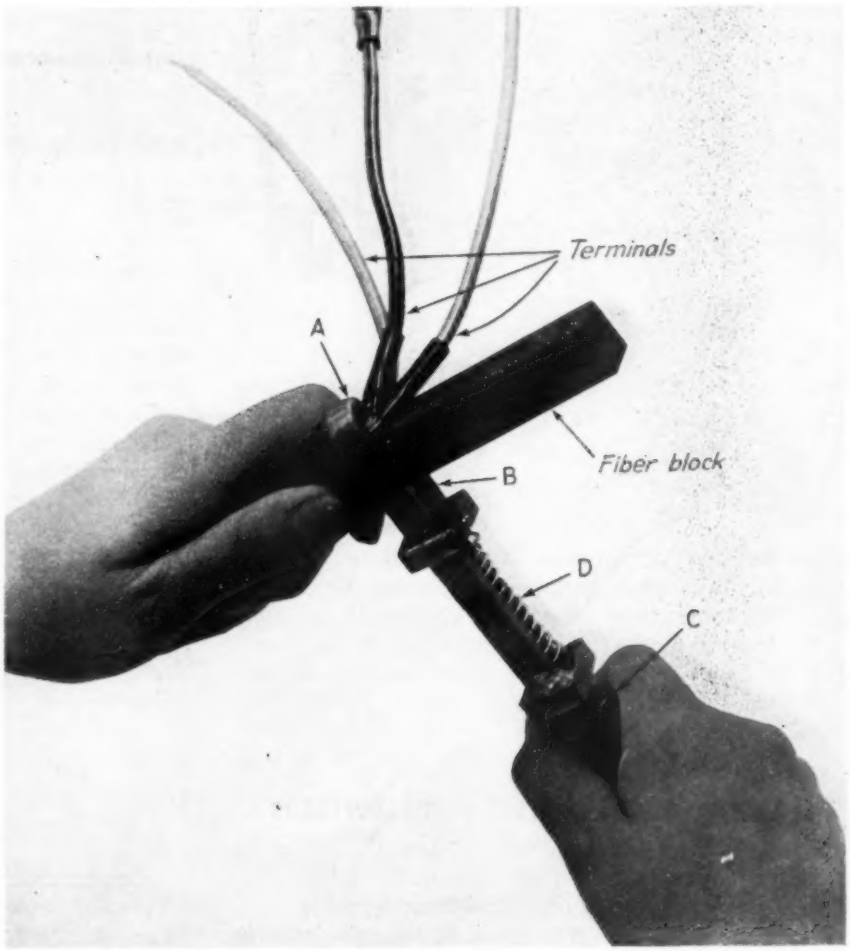
When installing new hobs in a gear hobbing machine, it was general practice to spot the gear blank and then measure the pitch diameter so as to adjust the hob and insure its proper position in the machine. On one reduction gear, it took approximately one hour to make a cut sufficiently large to take the required measurement. The proper position of the hob in the machine is now determined with the aid of the illustrated checking fixture comprised of dowel pin *A* upon which the hob is tightly fitted, and micrometer *B*, the barrel *C* of which is fixed permanently on block *D* doweled to base plate *E*.

Knowing that the hob previously used was cutting to proper dimensions, it is placed on the dowel pin and the micrometer is adjusted until it touches the outside of the tooth. The new hob is then similarly placed in the fixture and a second reading is taken. The difference in readings equals the distance the new hob must be set forward or backward in the machine to make an identical cut. The outside diameter of the gear blank is not finished ground at this point, and there is a variation in the size of the different blanks. There is also some variation in the hobs due to sharpening. These differences in measurements make

Combination Screwdriver and Socket Wrench

The illustrated job constitutes the attachment of a number of wires under the head of a bolt which passes through a fiber block and is secured by a washer and nut. It is necessary to make this nut secure to form a good electrical contact. This relatively simple operation is difficult to perform, since it is necessary to hold the wires in position, hold the screw in place, hold the fiber block, attach the nut and washer and use a socket wrench and screwdriver to tighten the nut. This actually became a three-hand job or necessitated the clamping of the fiber block in a vise. The latter is not desirable because of damage to the fiber block.

Because women employed on the job found the work difficult, the combination screwdriver and socket wrench was designed. Hook end *A* is ground to fit the slot in the head of the bolt. Hexagonal socket wrench *B* is rotated by handle *C*. Spring *D* holds the socket wrench on the nut. When using the tool, the bolt is inserted through the wire terminals and fiber block, and the nut is inserted in the socket wrench. After application of the washer, hooked

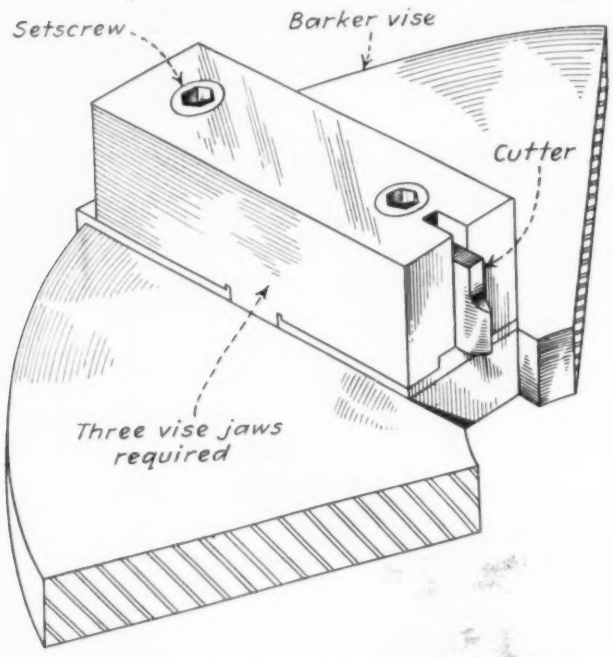


no difference in the cut once the hob is checked as described and properly set, because the pitch diameter remains the same on all gears cut with one setting.

Seventeen gear hobbers are being used in the plant where this checking fixture was built. With one change of hobs on each machine every day, this fixture effected a saving of 17 machine-hours a day. *Suggested by Michael J. Vorgitch, Packard Motor Car Company.*

Splits Defective Shell Rotating Bands

Removal of 37-mm. shell rotating bands found defective frequently resulted in marring the accepted shell. To eliminate this difficulty, three vise jaws, each carrying an adjustable cutter, were adapted to a No. 445 Barker vise. This vise can be mounted on a workbench in a flat position, and the three jaws advanced simultaneously. The shell is mounted vertically on a locating plug at the center of the vise with the rotating band directly opposite the cutters.

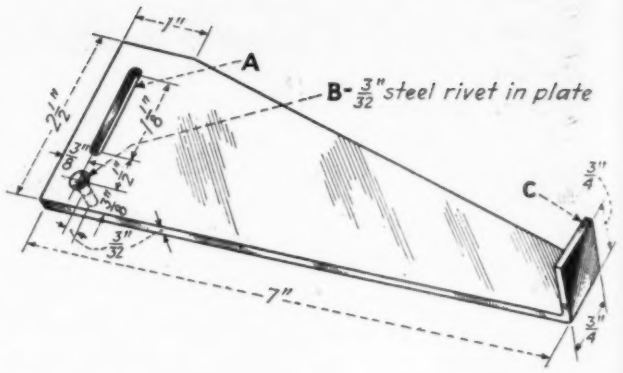


When the jaws are advanced into the defective rotating band, the cutters when set properly penetrate the band to equal distances because the shell is centralized accurately by the locating plug. The squeezing action of the cutters splits the band into three pieces, which are then removed easily from the shell. *Suggested by Andrew Tanko, International Harvester Company.*

"Oil-Cans" Removed From Plane Surfaces

The tool shown in the drawing is used for tightening aircraft stabilizer surfaces when depressions or "oil-cans" form around rivet holes during the riveting operation.

After inserting a $\frac{1}{8}$-in. rivet shank up through slot *A* in



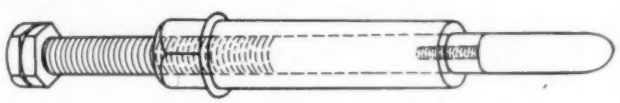
the tool, the tool is placed between the overlapping edges of the top and bottom skin. The inserted rivet shank is then brought up through the hole in the top skin, while the stud or rivet *B* is inserted in the hole in the lower skin. With the tool inserted in this manner, downward pressure is applied at end *C* until the depression has been eliminated. The holes are then reamed and bolts are applied to hold the skin in proper position until riveting has been completed.

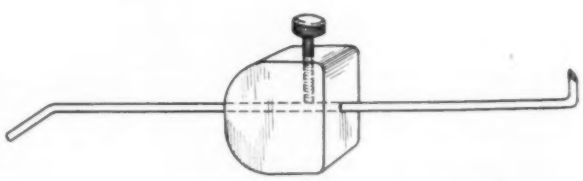
The depressions which this tool remedies do not occur frequently, but when they do this method has been successful in avoiding rework or scrapping of parts. *Suggested by Frank F. Brandt, Curtiss-Wright Corporation.*

Small Tools for Difficult Jobs

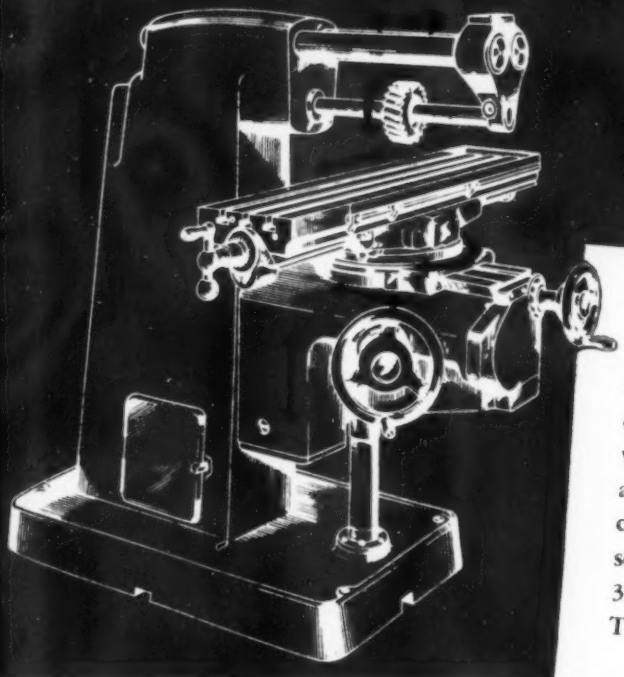
The threaded drift pin shown in the drawing was designed after a standard drift punch stuck in holes at several inaccessible locations where it was impossible to hammer the point and drive the pin out. Knocking the drift sideways injured the mating metal parts, which were made of aluminum. The new punch is threaded into a sleeve and held rigid by a locknut. Should the pin stick, the locknut can be loosened, the sleeve shouldered against the work, and the pin pulled out by unscrewing it through the sleeve.

The other tool was designed to measure the depth of a hole, open at both ends, but where only one end is accessible. The exact length of a screw, bolt or rivet can be determined. This eliminates the possibility of applying the bolt or rivet and finding it too long or too short. *Suggested by Ray Steele, Northrop Aircraft, Inc.*





How to Run a MILLING MACHINE



Tools of Our Trade, Number 3, presents for the new worker the basic information about the milling operation. The beginner coming to the shop from non-industrial life or the candidate for up-grading from some simpler shop operation will find here background information about the machines and tools he will use, how they should be handled, what he can do with them. Reprints of this section, as of its predecessors, are available from the Editor, AMERICAN MACHINIST, 330 West 42nd Street, New York, N. Y., at 10 cents a copy. There will be a slight reduction for lots of over 500.

In operating a milling machine you will be running one of the most versatile tools in the machine shop. Except for the engine lathe, no machine can perform so large a variety of jobs. With a milling machine it is possible to cut round shapes, finely finished flat surfaces, and irregular grooves and contours over a wide range of sizes and to a high degree of accuracy. Moreover, in the automatic types found in high-production shops, milling machines can turn out work at a rapid rate, assuring that the assembly lines which supply our fighting forces will not be held back.

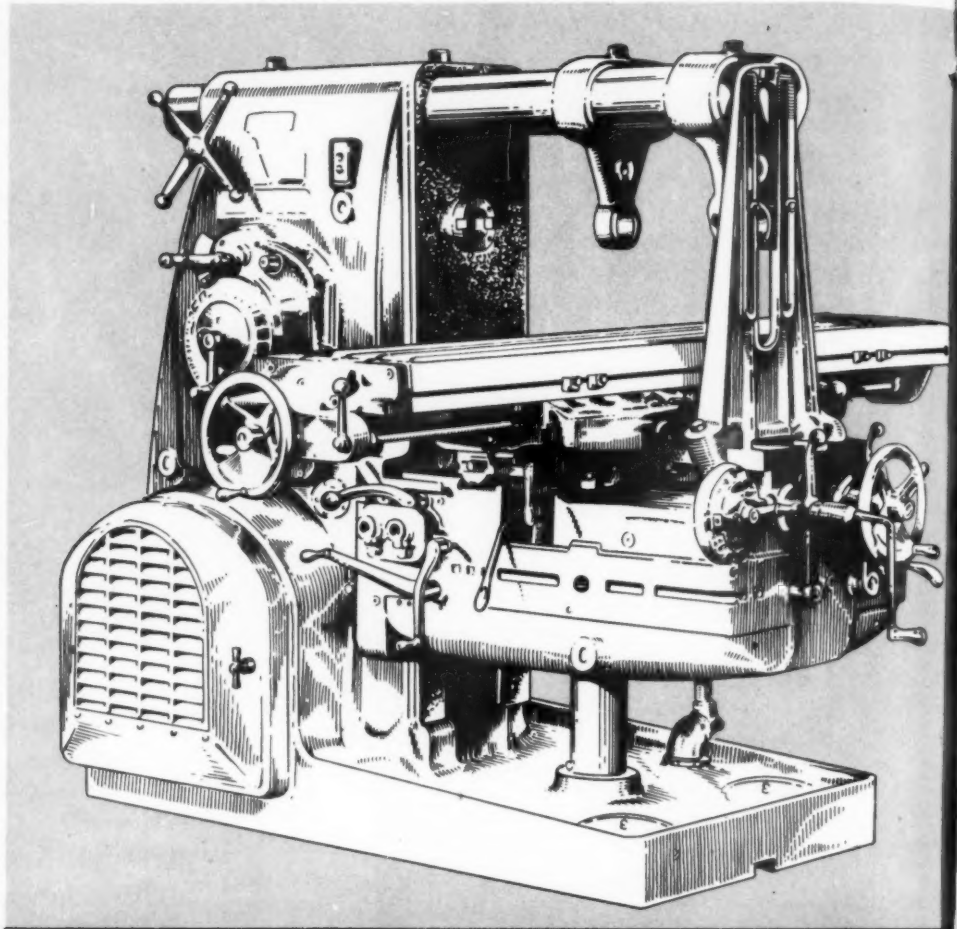
Basically, a milling machine is a device for cutting metal by feeding it into a rotating cutting tool. It consists of a power-driven spindle or arbor on which the multi-toothed cutter turns, and a movable table to which the work is clamped or bolted. The part is then cut by moving the table toward the tool by hand or power until the tool has cut into the work to the width and depth which the job requires.

As the following pages will show, this basic principle has been adapted to many specialized machines and attachments. Milling machines are made so that the table will raise or lower, move right or left, in or out, or swivel at an angle. The cutter may be mounted so that it is horizontal or vertical to the table or at any angle to it. By means of special indexing attachments, straight or helical cuts may be made on cylindrical pieces.

The variety of cutters available further increases the machine's versatility. Standard types are made in widths ranging from 1/32 in. to 12 in. and in shapes and styles for all classes of work.

In its adaptability to nearly every sort of metal-cutting job, the milling machine is a great help to the production engineer. In its almost limitless possibilities for interesting setups, it offers a great challenge to the operator.

TYPES OF MILLING MACHINES

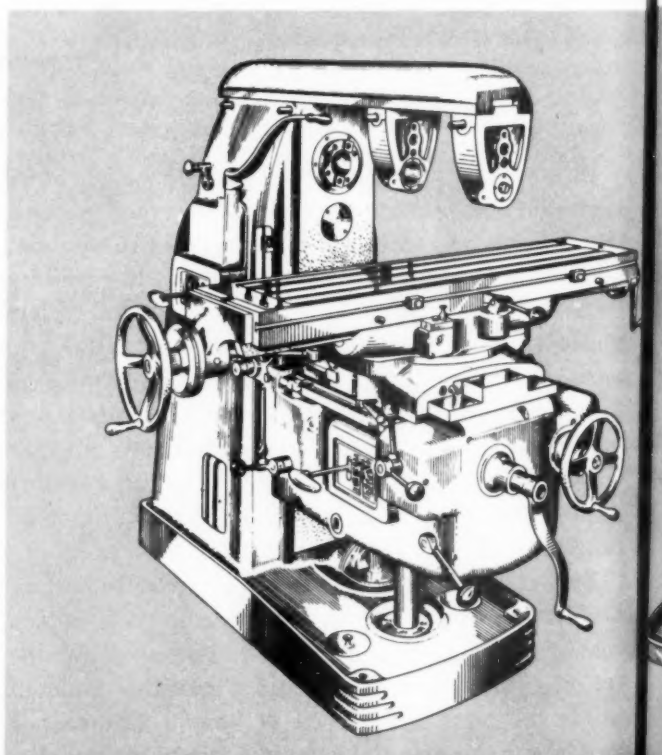


PLAIN MILLING MACHINE

MOST MILLING MACHINES are made with knee-and-column construction. In this form the cutter spindle and machine table are supported on an upright box column. The table is supported by a knee which moves up and down the face of the column to give the vertical adjustment, and a saddle is mounted on the top surface of the knee to give the movement to and from the column. The table proper is then mounted on the saddle to give the movement across the face, the longitudinal feed.

When the table action consists of these three movements — vertical, cross and longitudinal — the machine is called a plain milling machine. When, in addition, the table can be swiveled on the saddle, usually through 45 deg. or more, the tool is called a universal miller.

In any of the directions possible, the table can be moved by power as well as by hand. When power is used, the speed of travel can be controlled by change gears so that the rate of feed of the work to the cutter can be regulated. The feed can usually be arranged so that it moves slowly in making the cut and then returns rapidly to the starting position. This quick traverse saves much production time.



UNIVERSAL

Since each hand feed control has a graduated dial, the table can be moved by hand within limits of 0.001 in. This permits locating and taking cuts to very exact dimensions.

In horizontal knee-and-column machines, power is supplied to the cutter through a hollow shaft, called a spindle, located in the upper part of the column. The nose of the spindle contains a hole having a 3½ in. per foot taper into which the cutter-holding arbors fit.

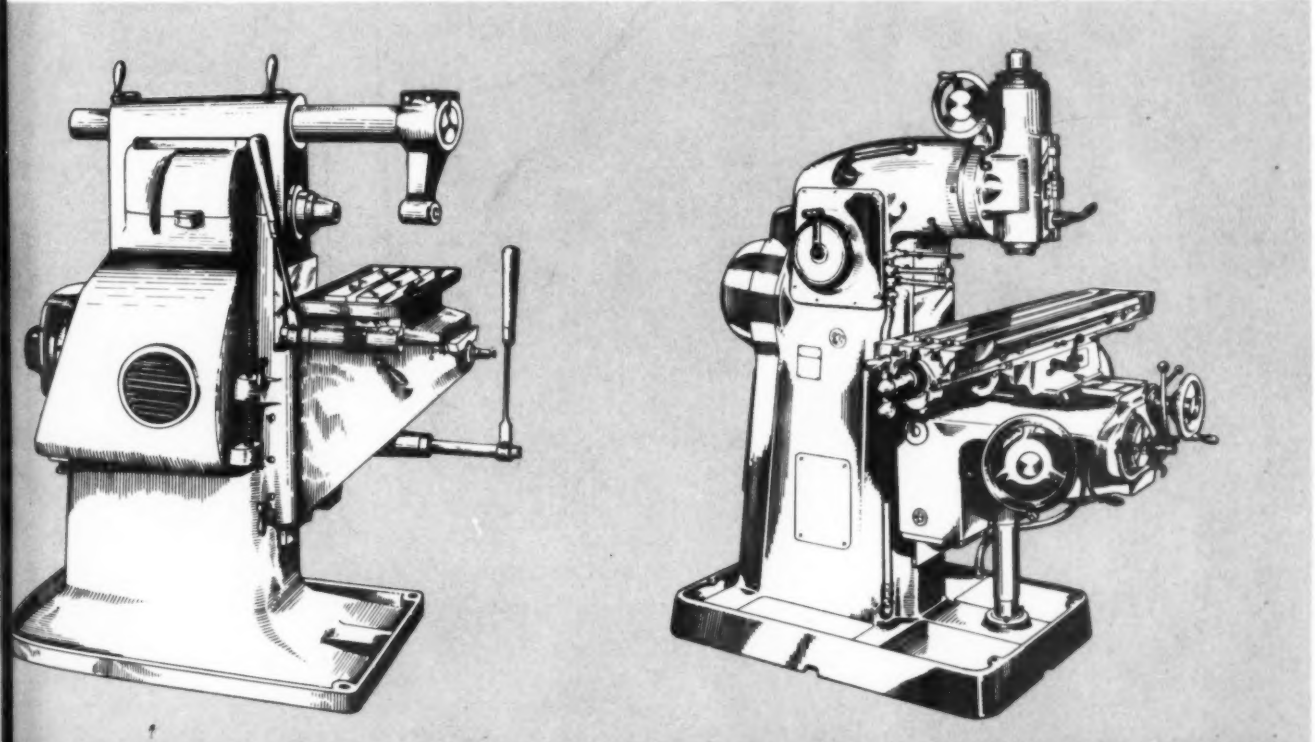
To give the cutters the steadiness necessary for fine and accurate finish, the outer end of the arbor is also supported. This is accomplished by beam-like structures called overarms which extend from the top of the column. These may be either single or double bars extending from the column or solid rams mounted on the finely finished, dovetailed upper surface of the column. Either type may be clamped firmly in place. Supports for the arbor are suspended from the overarm and are clamped to it.

Both knee-and-column and solid base, bed-type machines are also made with vertical and universal spindles. These are used in manufacturing installations requiring a lot of end mill or facing operations. Some vertical spindles are only adjustable vertically, others swivel through 360 deg. across the face of the machine. Universal spindles also swivel through 360 deg. across the table, making possible any angle between the cutter and the horizontal plane. One common type of universal machine has the spindle mounted on a ram-type overarm so that the cutter can be located at various points across the table.

Besides supporting the table and the cutter, the column usually contains the motor and drive gears and the change gears for controlling the spindle speeds. In the older cone-pulley styles, the drive pulleys are also mounted on the column, as is such special apparatus as the coolant pump and return system.

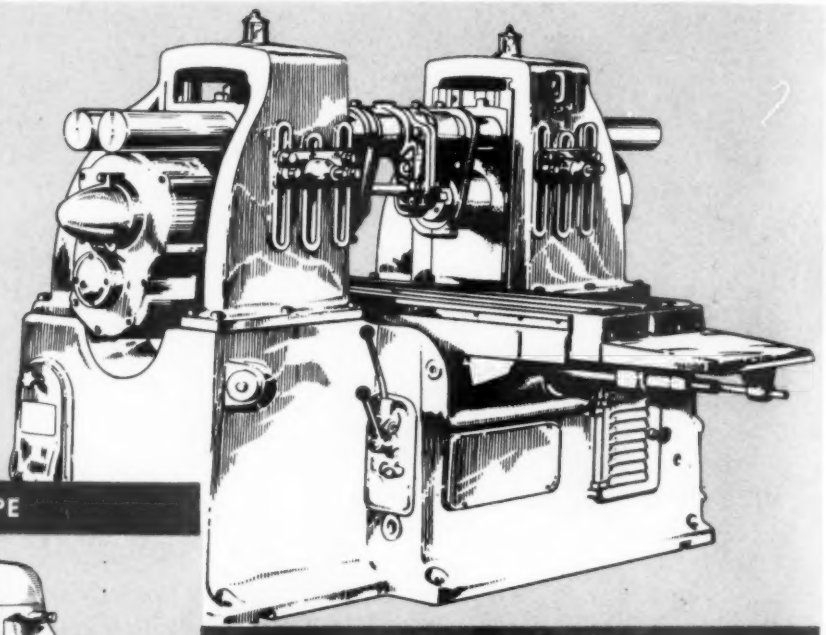
The simplest forms of milling machines are the hand miller and the manufacturing or bed-type machine. In these, the adjustments of spindle and table are limited. The bed type has a rigid base supporting the table at a fixed height so that it can only move across the face of the machine. The spindle can be raised or lowered to accommodate pieces of various heights. Because of the limits on the table movement, only pieces requiring straight cuts can be machined on this type of miller. However, the simplicity of the table makes it especially adaptable to automatic operation, while the rigid base gives a firm support for heavy pieces and heavy cuts. It is, therefore, a valuable production tool.

Hand millers, which are used on many small parts, are made in two different types. Both have longitudinal and vertical feed, and most examples also have a cross feed. In one major type the vertical feed is accomplished by raising or lowering the spindle; in the other, by moving the table. In both types, all



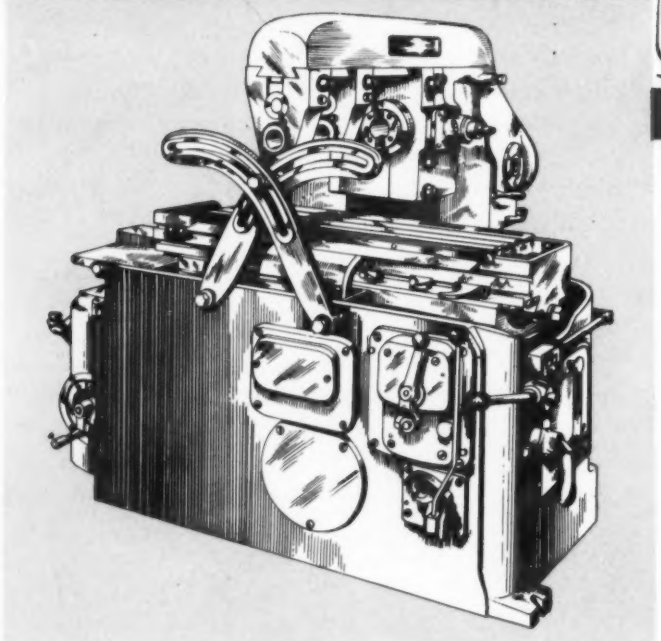
HAND VERTICAL

To meet the demands of modern high production, many types of automatic milling machines have been developed. Some can perform any number of complicated cycles of operation; others are specially built for high production of one part. Single and duplex automatic machines are two of the most adaptable types



DUPLEX AUTOMATIC

AUTOMATIC BED-TYPE



feeds are by hand, levers being provided to move the table longitudinally or to raise or lower the table or spindle. The use of hand levers gives both a quick and sensitive feed. Either the horizontal or vertical feed can be locked while the other is used and stops can be set on the table to limit the travel in either direction. Thus it is possible to make cuts of carefully regulated length and depth. When used with quick loading and emptying holding devices, the hand miller will turn out work in a very efficient manner.

Another machine for milling small work is the bench type. This is usually a precision tool built as a diminutive version of either the plain or universal form. In the past these machines have been used chiefly in toolroom work. However, because they take up much less floor space and are adequate for the job, bench millers are coming into frequent use in small parts manufacture.

The milling principle is used in many machines besides these common types. Milling heads — the part holding and driving the cutter — are combined in many standard and special machines. One of the commonest of these is the planer type, a machine devised to mill surfaces on very large parts. In this type, the work is carried under or past the cutter on a large power-driven table, while the cutter may be moved back and forth or up and down on a heavy beam-like structure that spans the table. In the planer type, milling heads may also be mounted at the sides of the table. On another type of special machine, the work is supported on a large horizontal rotary table. Various special machines for high-production work are made to carry parts past a series of cutters which perform a number of separate operations in one pass of the table.

For modern mass production, many automatic milling machines have been developed. These usually require no more of the operator than that he load special holding devices and push buttons to stop and start the machine. They may be driven either by mechanical or hydraulic means and are usually electrically controlled. The duplex automatic is one type frequently used. In this, two sides of a piece are cut at once. The machine can be set so that both the table and cutter move in complicated cycles; the table moving forward and back, quick and slow, and the cutters moving in and out to cut to different depths.

MILLING CUTTERS

A CROSS SECTION of the cutting tool used in milling machines would look very much like a circular saw. In fact, milling cutters are used for many sawing operations. However, though milling cutters are made as thin as 1/32 in. for sawing and slotting, they are also made 12 in. or wider for machining broad flat surfaces. Moreover, they may be made with profiles of great variety to cut such standard shapes as gear and sprocket teeth, internal and external radii, screw threads, taps, reamers and other milling cutters, as well as being specially designed to cut unusual shapes — such as plier jaws — in one operation.

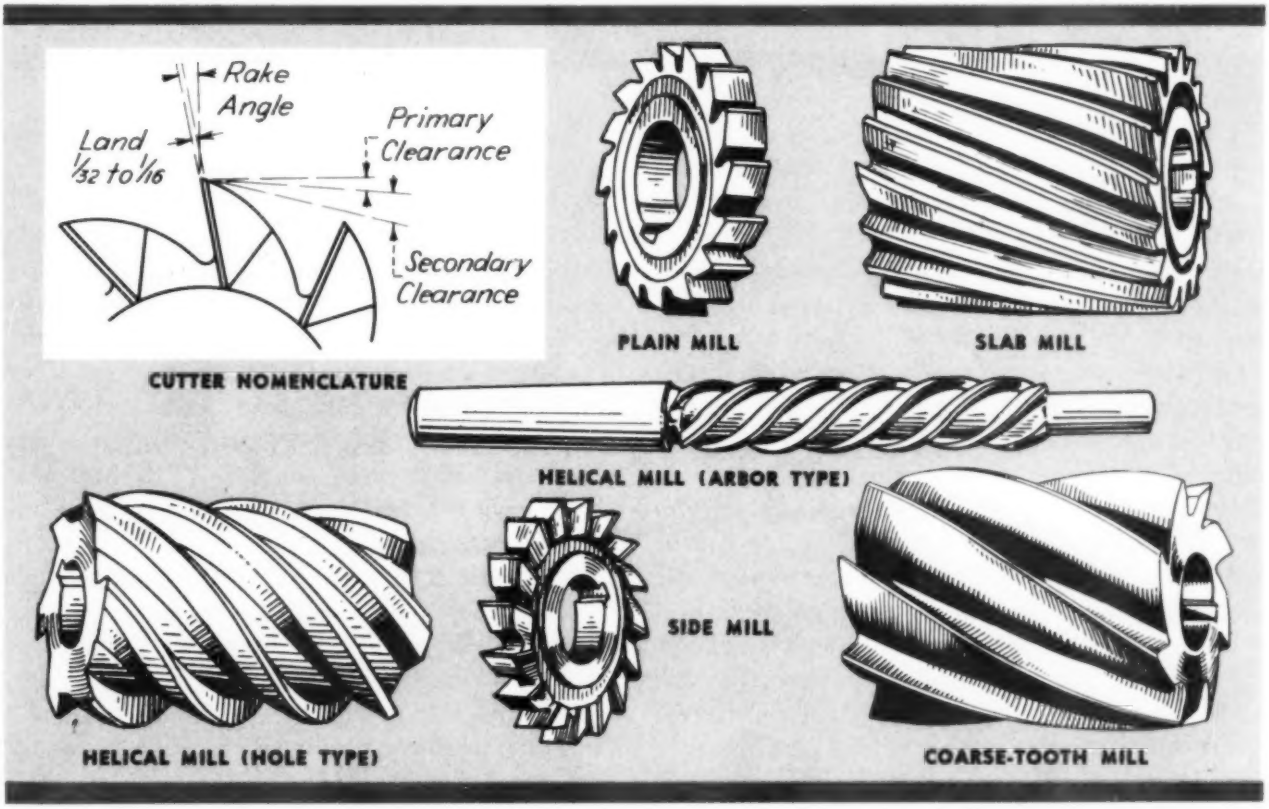
The teeth of milling cutters are made in two different styles, the particular style determining the manner in which the cutter should be ground. One style (called profile cutters) is sharpened by grinding a narrow land on the periphery back of the cutting edge. They are usually designed for cutting flat surfaces. On the other type (formed cutters) the relief back of the cutting edge is made to the same contour as the cutting edge. Such cutters are ground on the face of the tooth, which is a radius of the cutter, so that the shape of the tooth remains the same throughout the cutter's useful life. Most cutters having curved or irregular outlines are made in this style. They have a longer life and are easier to sharpen than profile cutters of irregular shape.

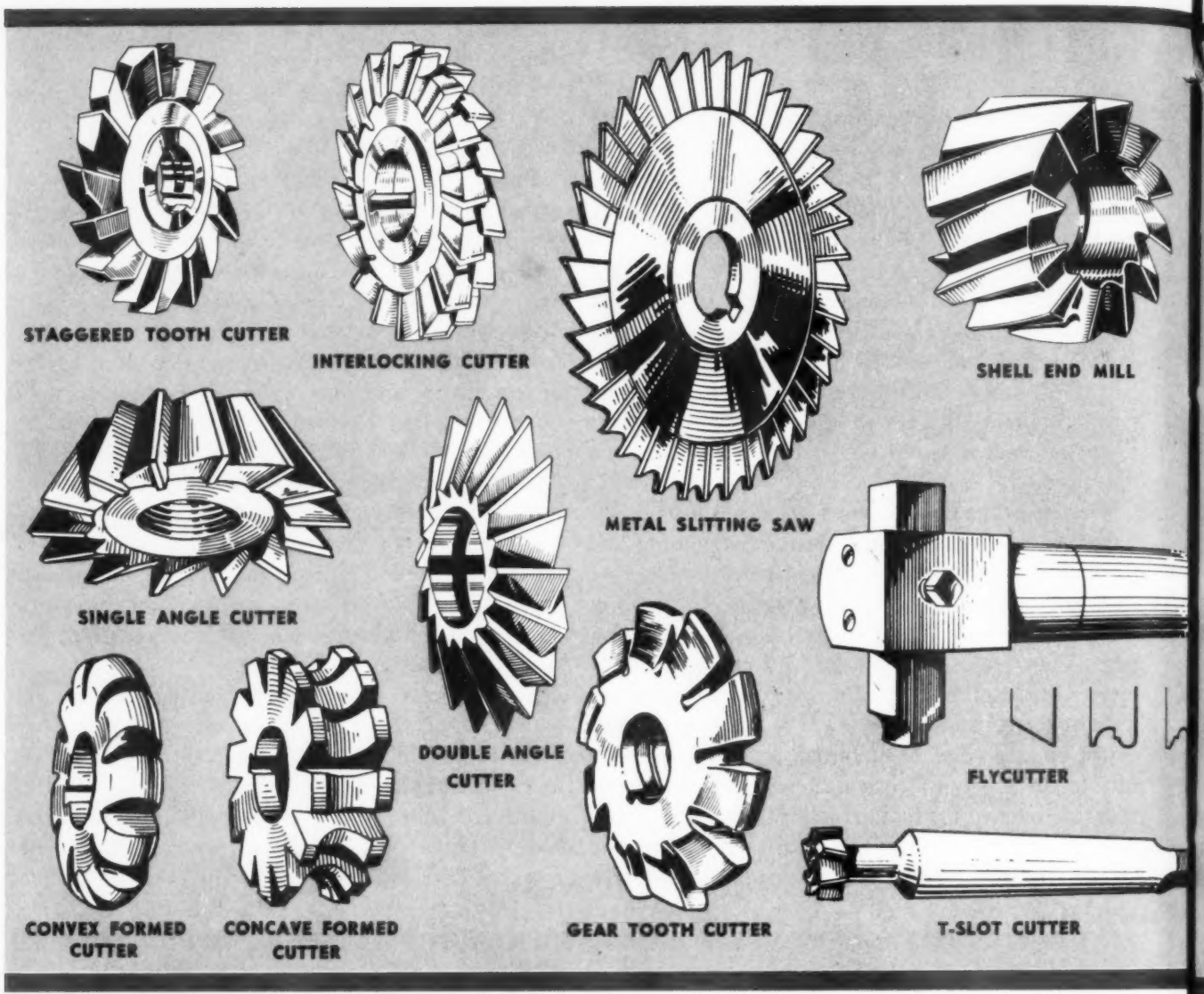
The cutters shown are the more common forms used in general milling. The following types are profile cutters:

PLAIN MILLING CUTTERS have a cylindrical shape with teeth on the outer surface only. They are regularly made in widths from 1/2 in. to 12 in. The wider cutters are often called SLAB MILLS. They are used for milling flat surfaces. Cutters under 3/4 in. are usually made with straight teeth, wider ones with helical teeth. Helical teeth give a shearing cut which results in less chatter and finer finish. The name HELICAL CUTTER is often reserved for cutters having fewer teeth and a more pronounced curvature of helix. They are sometimes made with a built-in arbor for use in milling slots which go through the work.

COARSE TOOTH CUTTERS have been developed to take advantage of higher cutting speeds. The greater space between teeth allows more room for chip clearance. Modern practice calls for the use of coarse tooth cutters wherever possible.

SIDE MILLING CUTTERS have teeth on both sides as well as on the circumference of the cutter. They are used to mill slots or, in pairs, to mill both sides of a piece at once to a given dimension. This latter practice is called straddle milling. Half-side cutters have teeth on only one side as well as the circumference. They are used for straddle milling or wher-





ever side teeth are necessary on only one side of the cutter, as in milling to shoulders.

STAGGERED TOOTH CUTTERS are used to mill deep slots in steel. They are made so that alternating teeth cut opposite sides of the slot. This makes for free cutting action and avoids chatter. The short chips removed do not jam in the slot.

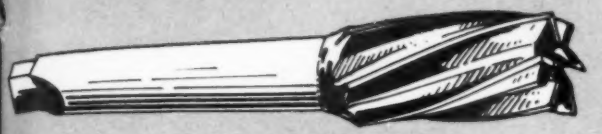
INTERLOCKING CUTTERS are also used to mill slots to exact widths. The width of the cutter may be adjusted to precise dimensions by inserting thin metal shims or collars between the interlocking parts.

FACE MILLS are another style of cutter for machining flat surfaces. They are mounted on the end of short arbors which hold them close to the spindle nose. The cutting edges are usually high speed steel or carbide tipped teeth inserted in a tough steel body. The teeth on the periphery remove most of the metal; the edges on the face clean up the surface.

SLITTING SAWS are used for sawing metal parts or cutting narrow slots. They are made as thin as 1/32 in. For cutting soft metals, the teeth are sometimes pointed or staggered in some way.

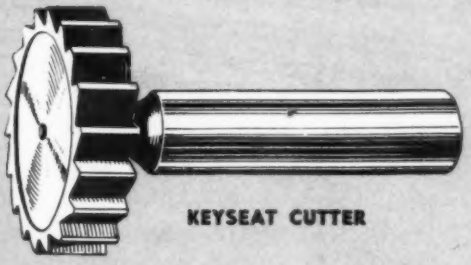
END MILLS have cutting edges on both the side and end. They are used to cut slots having closed ends, irregular recesses, cam outlines, and in many other applications. Some have a SOLID SHANK which can be adapted to fit the standard spindle nose. SHELL END MILLS are mounted on a separate shank on which they remain throughout their useful life. When worn out, the cutter section is removed and a new one mounted on the shank. TWO-LIP END MILLS, having either straight or helical teeth, are chiefly used for slotting.

ANGULAR CUTTERS have cutting edges at an angle to the cutter axis. SINGLE ANGLE CUTTERS are regularly made with included angles of 45 or 60 deg., DOUBLE ANGLE CUTTERS with 45, 60 or 90-deg. angles. They may be keyed on an arbor for use in a horizontal machine or mounted on a taper shank for use in a vertical spindle.

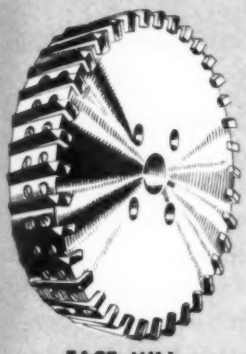


SOLID SHANK END MILL

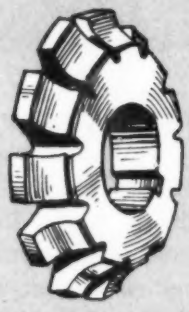
TWO-LIP END MILL



KEYSEAT CUTTER



FACE MILL



CORNER-ROUNDING CUTTER

SMALL CUTTERS of standard sizes are made for cutting KEYSEATS and T-SLOTS. These are usually plain milling cutters but may be of staggered tooth design. SINGLE TOOTH ELYCUTTERS are often made in the tool-room for special small-lot jobs. These give a fine, accurate cut but are not adapted to heavy duty, high production work.

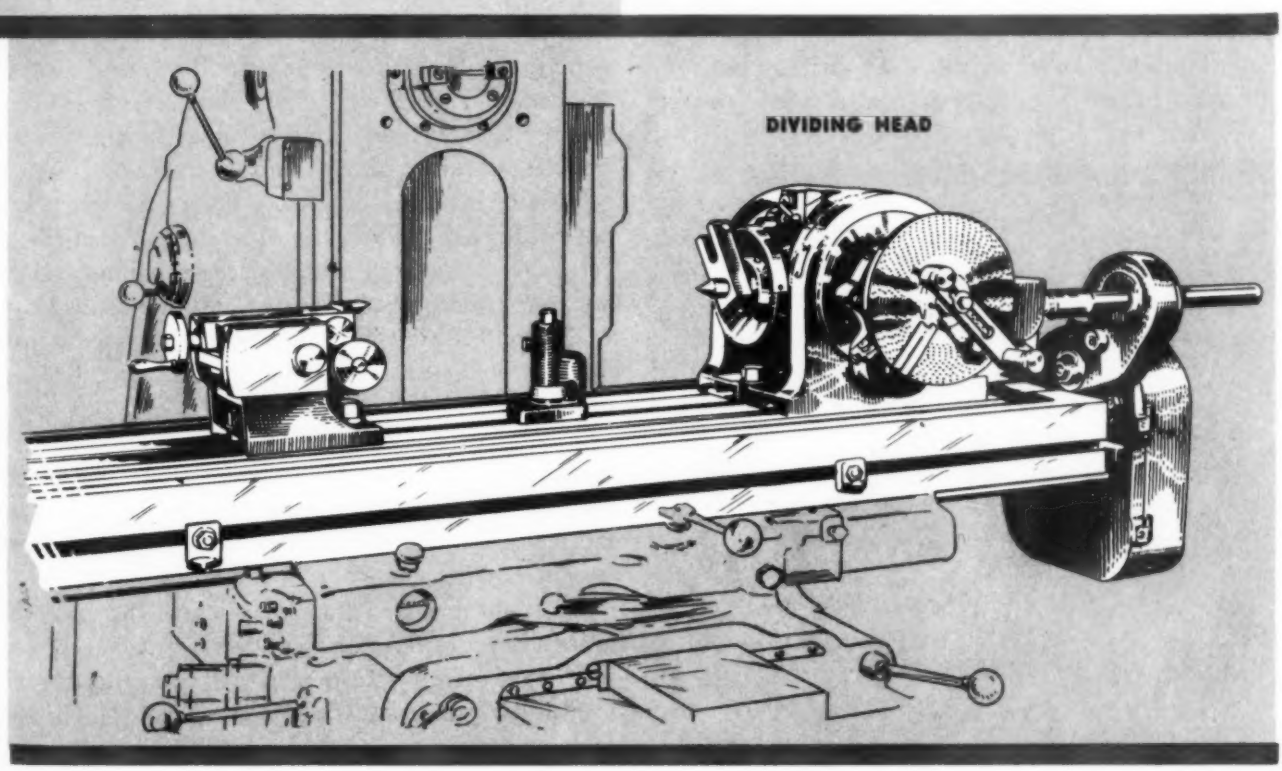
Among the more common formed cutters are the following:

GEAR TOOTH CUTTERS reproduce the standard involute curve of a gear tooth. The size of the cutter used is determined by the pitch and number of teeth of the gear to be cut.

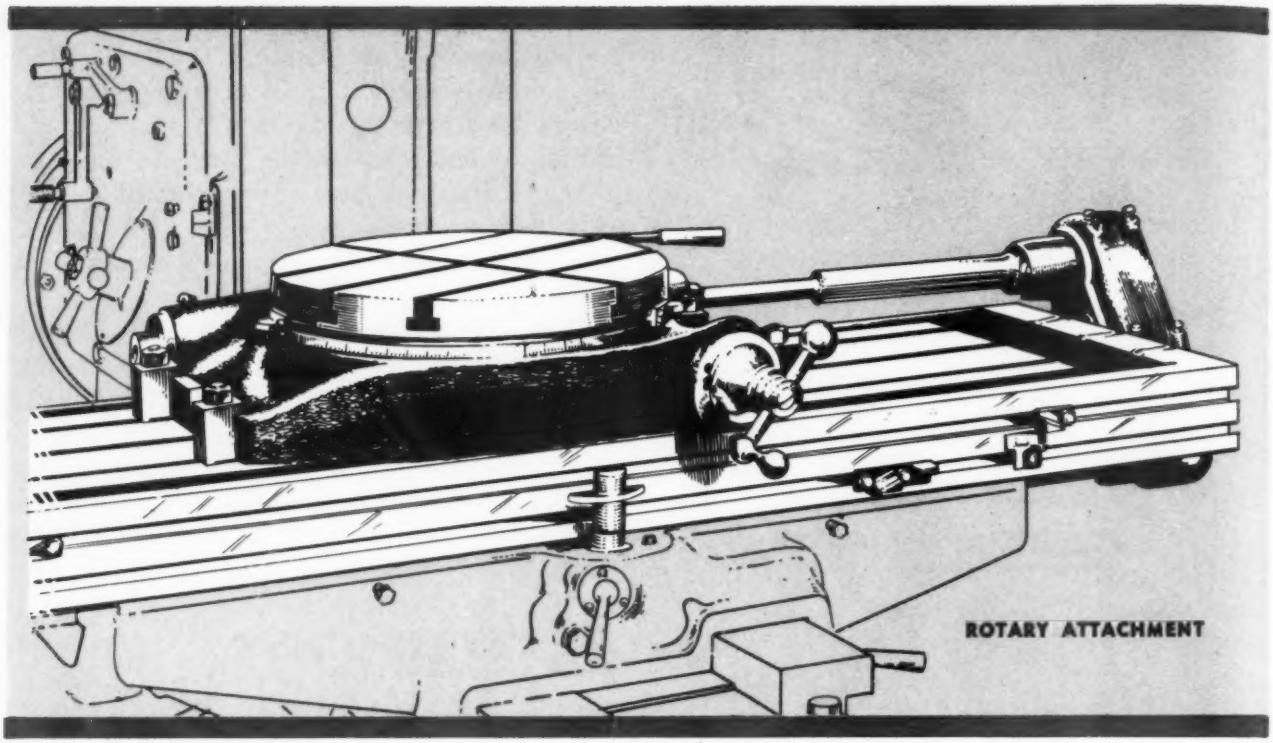
CONCAVE and CONVEX CUTTERS are made for milling half circles. CORNER-ROUNDING CUTTERS are made for milling either on the right or left side of a piece.

ATTACHMENTS

TO INCREASE THE ADAPTABILITY of their machines, the manufacturers of milling equipment have developed a number of attachments to perform additional jobs on standard machines. Among the most useful of these is the dividing head. This is a device for turning work so that a number of cuts may be exactly spaced around a piece of work. When attached to the table by a gear train so that the work turns as the table moves, it can also be used to make helical cuts.



DIVIDING HEAD

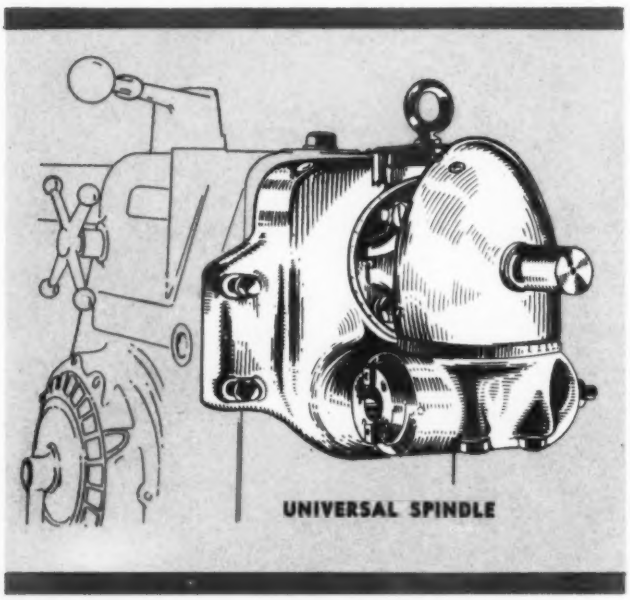


ROTARY ATTACHMENT

The work may be held between centers or may be held in a chuck mounted at the headstock center.

On this device a crank is geared to the work center in such a way that one revolution of the crank will move the center through part of a revolution. Usually 40 revolutions of the crank equal one of the center. On the crank shaft, a plate having several circles of holes, each circle of a different number, is mounted. A pin on the crank slips into these holes to hold the crank at any point. By choosing an index plate having the right number of holes, the dividing head can be used to divide a circle into almost any number of parts, with either equal or unequal spacing.

To obtain a particular division requires only a simple computation. Thus, if 36 teeth are to be cut on a gear, divide 40 by 36. This gives 40/36 or 1 1/9 revolutions of the crank as necessary for one division. An index circle containing a multiple of 9, such as 27, is chosen, and 1/9 of this number found. Therefore, to cut 36 teeth, the index must be moved one revolution and three holes on the 27-hole circle for each cut. Divisions numbering over 382 usually require the addition of change gears between the crank and center. To save the worker the necessity of computing these, milling machine manufacturers have worked out tables for divisions up to 1008.



UNIVERSAL SPINDLE

Where the amount of work done in a shop does not call for a regular vertical machine, supplementary vertical and universal spindles are available to adapt horizontal machines for vertical milling jobs. Many vertical milling attachments can be swiveled across the face of the column, while universal spindles can be swiveled in all directions.

Where circular cuts must be made, a rotary feed is necessary. This can be obtained by using a rotary attachment, which is a small table to be bolted on the machine table. It can be rotated either by hand feed or power.

Among the other attachments available may be listed thread, cam and rack milling attachments, slotting attachments, tilting tables, attachments for increasing spindle speeds, and micrometer spindle and table adjustments.

SETTING UP THE JOB

THE MILLING MACHINE is a precision tool. Each of the hand feed controls has a dial marked off in thousandths of an inch so that the table can be moved and parts machined to 0.001 in. accuracy. But this precision is not possible unless the machine is carefully prepared for the job. The setting-up of the work is the most important function of the operator.

The order of operations is important. In general, the following order is best.

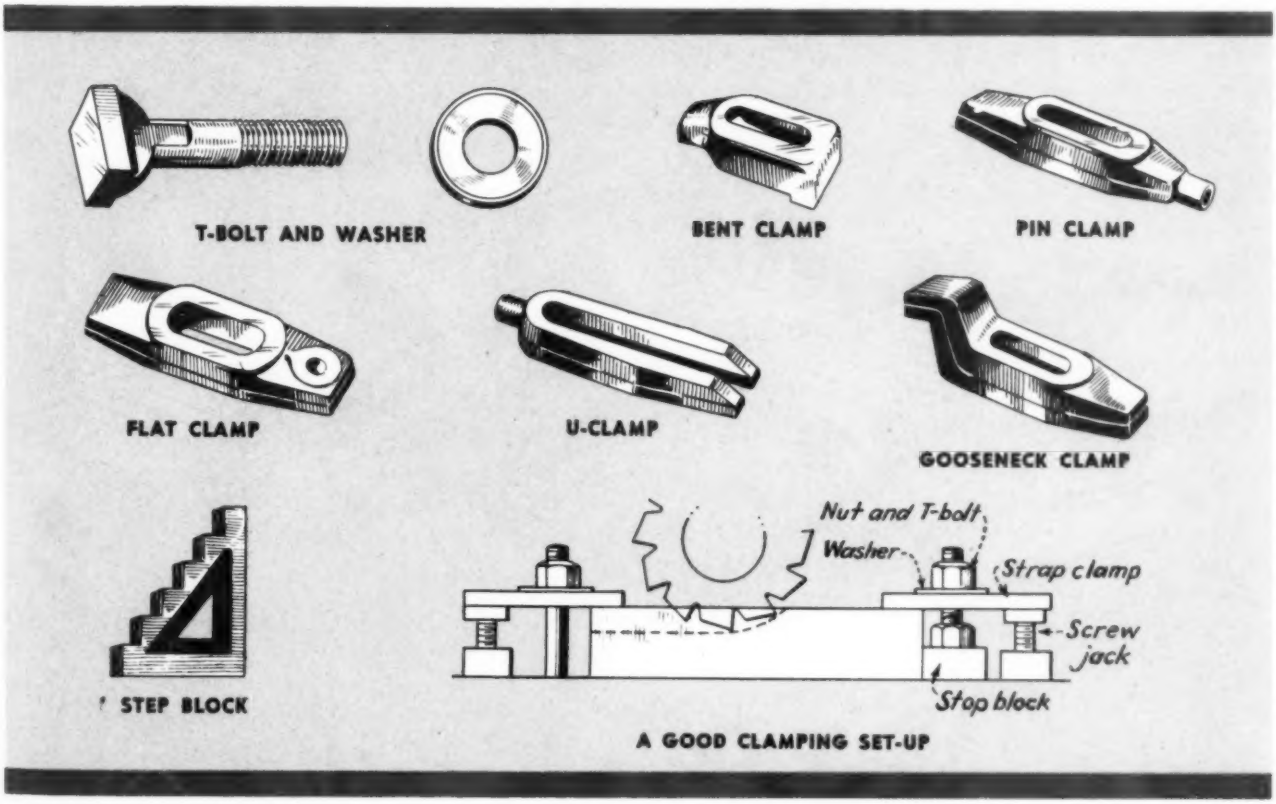
1. The machine is cleaned thoroughly.
2. The holding device and cutting tools are obtained from the toolroom.
3. The holding device is mounted on the table.
4. The alignment of the holding device is checked.
5. The work is placed in the holding device.
6. The cutters are mounted on the arbor or in the spindle to align with the work.
7. The trueness of the cutter set-up is checked.
8. The set-up is examined to make sure cutters will not strike the holding device.
9. Stops are set to limit table travel.
10. A trial piece is cut and inspected.
11. Faults in the set-up are corrected.
12. Production is begun.

The cardinal factor in set-up is cleanliness. A speck of dirt only a thousandth of an inch thick, caught between the arbor end and the spindle or between the cutter and the arbor, may cause the cutter to run several thousandths out of true. Chips lodged between the work and the fixture may also cause great inaccuracies, while dirt in T-slots can cause a fixture or clamping arrangement to be misaligned and the resulting cut out of square.

The first step, then, in getting ready for a job is to clean the machine thoroughly. All chips and other dirt should be removed from the table and T-slots. The spindle nose, arbor support bearings, and arbor should be free of burrs or foreign matter. The ways on which the table rides should be wiped clear of gummy oil. The overarms should be thoroughly cleaned of oil and dirt.

Clamping the Work

When all dirt has been removed from the machine the holding device to be used may be mounted on the table. The holding device may be a machine vise, a special fixture or, for large pieces or small lots, an arrangement of clamps. If an arrangement of clamps is called for, a variety of types are available. They may be simple flat steel straps with a hole or slot cut in them or they may be formed to certain shapes that have been found useful. U-shaped clamps can be adjusted without removing the nut. Bent strap or gooseneck clamps make possible low set-ups which give more clearance for the worker or tools. The



clamps are fastened with T-bolts which fit the table slots and are held down with nuts and washers.

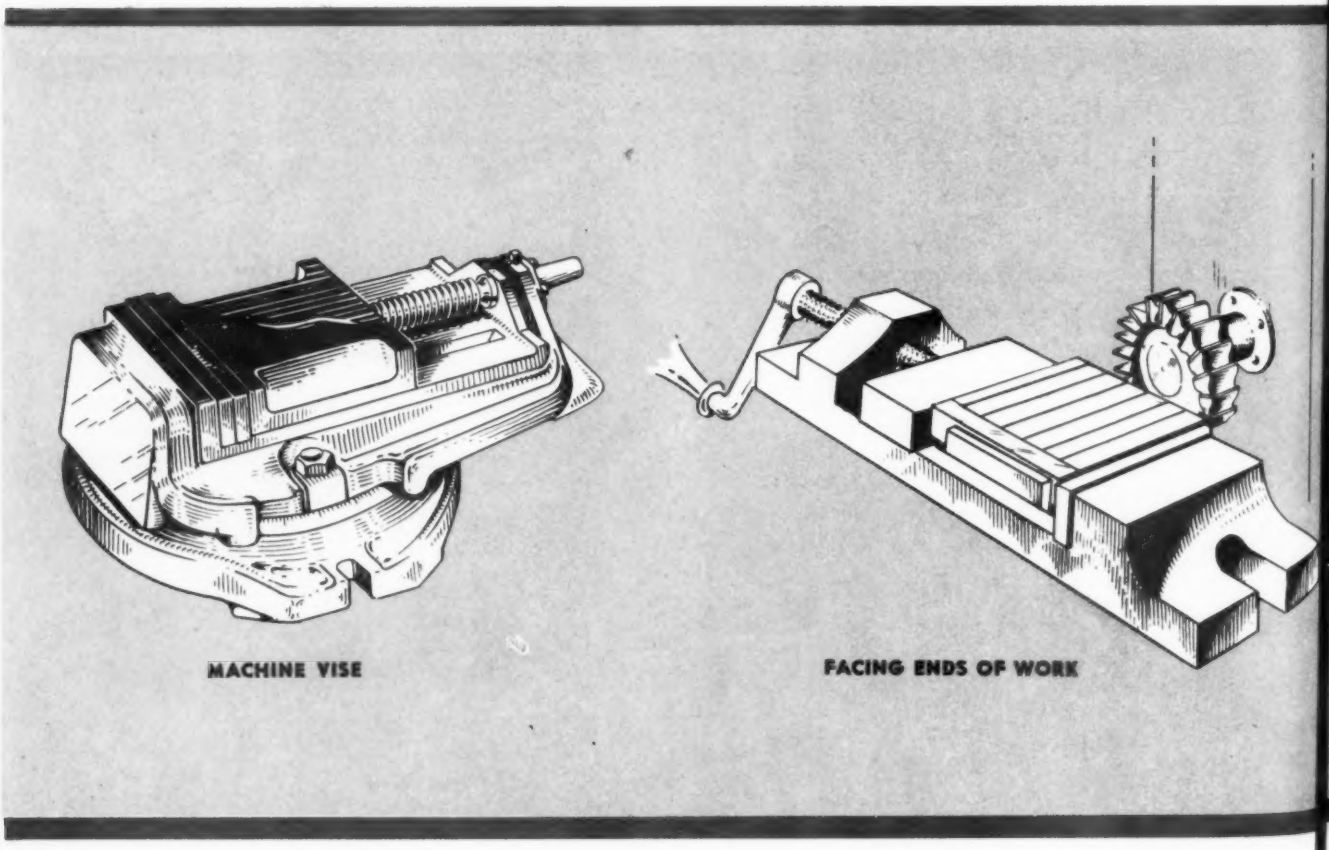
A clamp set-up must be very rigid. This is assured by seeing that enough clamps are used, that they seat firmly on the work and the supporting block or jack, and that the bolts are as near the work as possible. Because the action of the cutter tends to force the work along the table, a stop block or pin should be used to oppose this action. When the clamp must bear on a finished surface, a thin piece of soft metal should be placed between the clamp and the work. When a rough unfinished surface must rest on the table, a protective base of cardboard or some other material should be placed under the work. If this is done, however, the position of the cuts must be carefully checked.

Vises as Holding Devices

A great many milling jobs can be held conveniently in a vise bolted to the machine table. With a plain vise, almost any piece having two parallel sides can be held. For odd-shaped pieces which must be made in quantity, special jaws may be supplied. One of the commonest uses of vises is to hold pieces which must be cut to a specific size. If only one end is to be cut, a stop may be set in a slot in the vise base and a parallel rested against it. The finished end of the pieces can then be rested against the parallel while the other end is cut. If two ends are to be cut, a pair of straddle mills may be set at the precise width. The pieces are then allowed to project from each side of the vise so that they are spanned by the cutters.

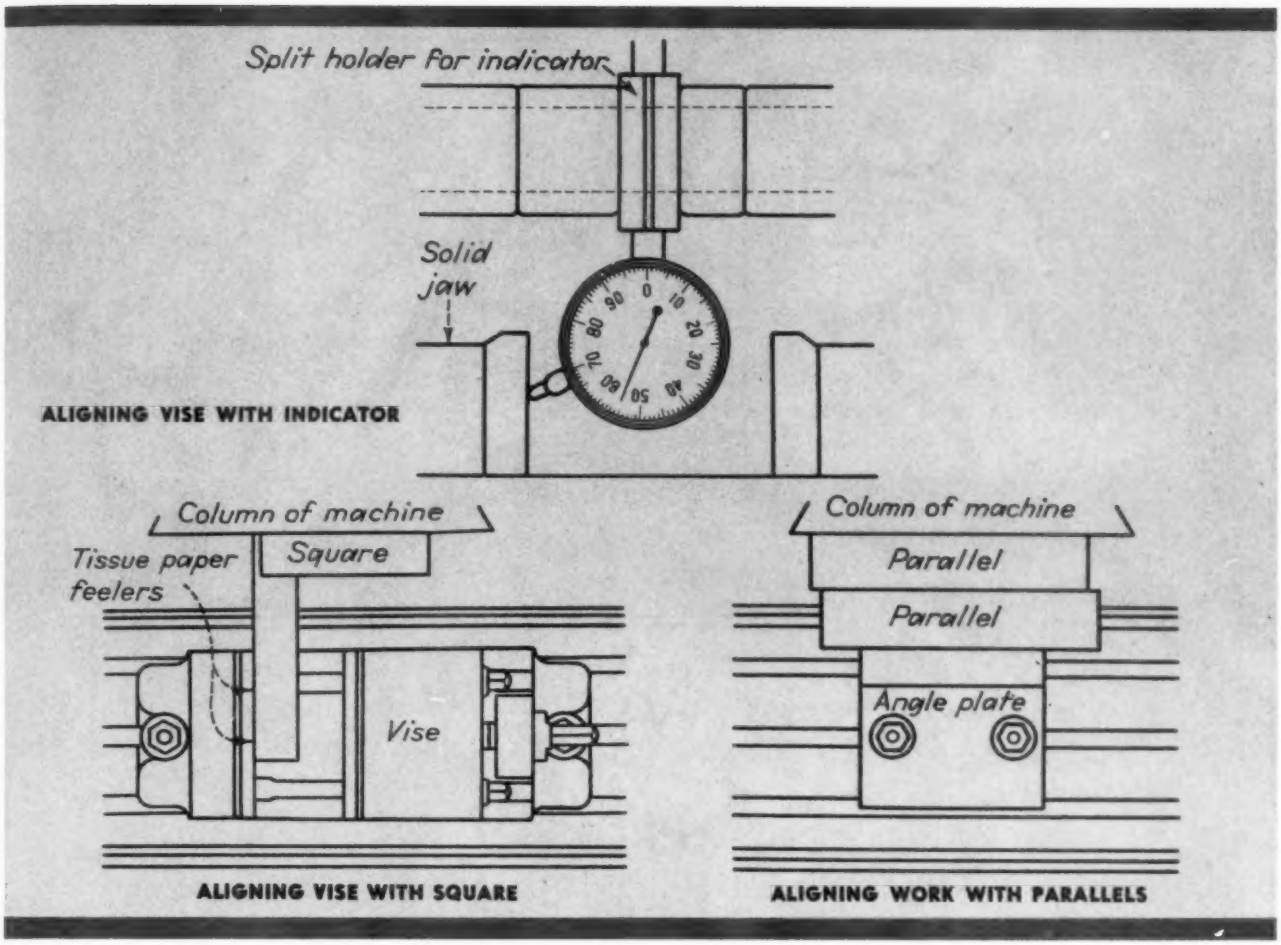
Lining Up the Job

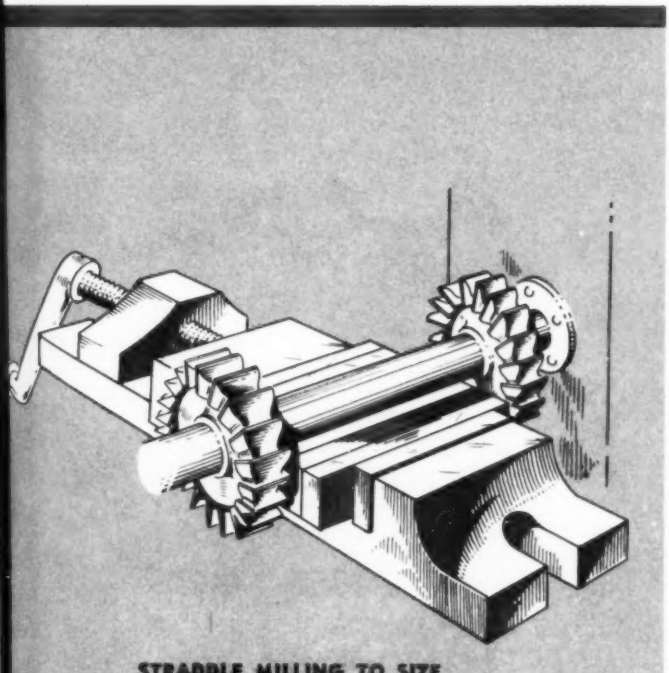
In order that work held in a vise be cut exactly, the jaws should be aligned perpendicular or parallel to the cutter arbor. There are a number of ways of doing this. A dial indicator may be fastened to the arbor with the indicator point resting on the fixed jaw of the vise. Hand feed is then used to move the vise jaw past the indicator. When the dial shows no variation between the two sides of the vise, it is aligned. In another method, the base of a machinist's square is rested against the column face and the blade is brought in contact with the fixed jaw with tissue paper feelers placed between the blade and the jaw. When an equal pull is necessary to remove the feelers all along the blade, the vise is aligned. Some types of set-ups may be aligned by placing carefully machined parallels between the vise, angle plate or fixture. Since any dirt or irregularities between the work, parallels and column will cause inaccuracies, all parts must be perfectly clean and free of burrs.



MACHINE VISE

FACING ENDS OF WORK

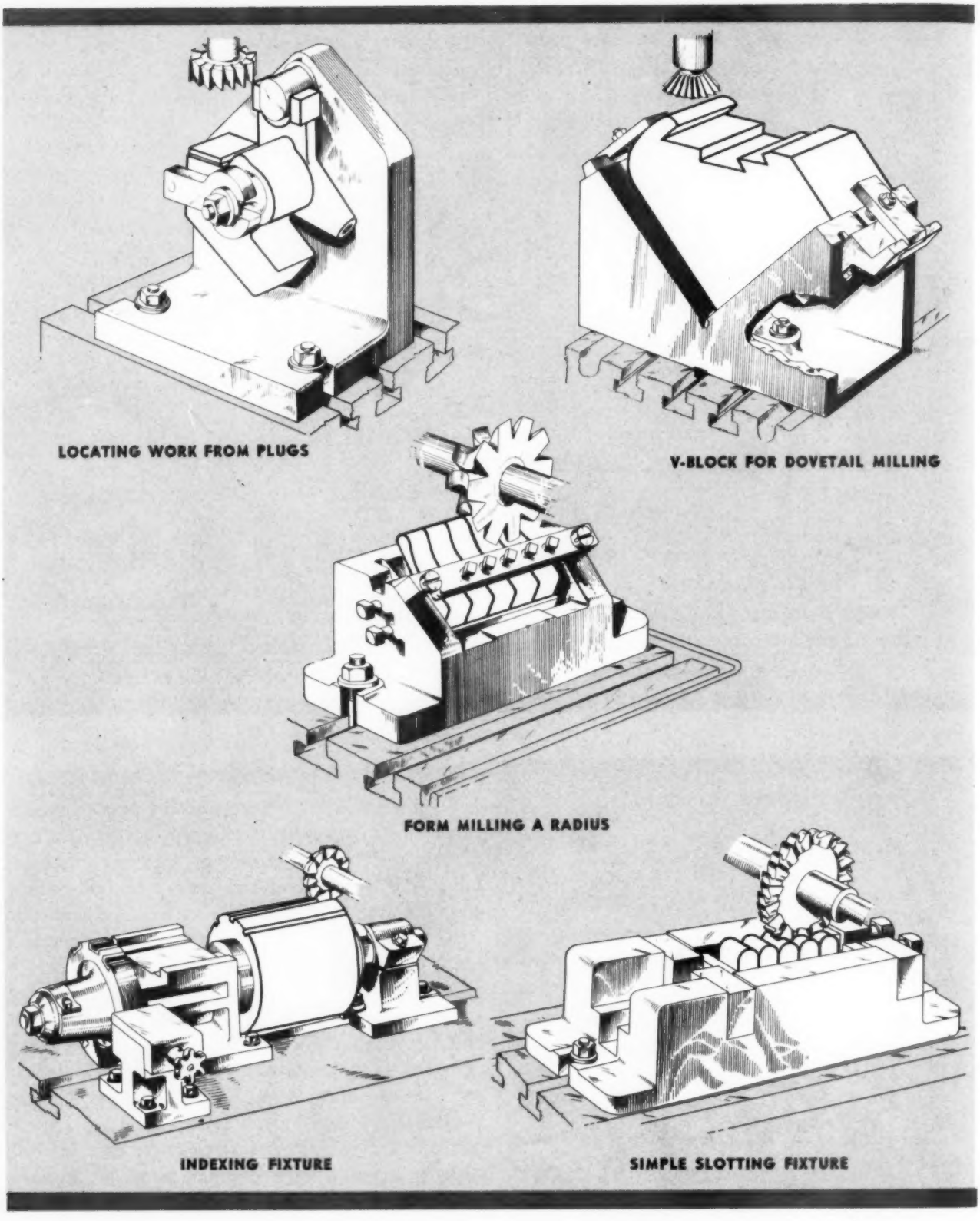



STRADDLE MILLING TO SIZE

The Use of Fixtures

In production work, pieces of complex shape are usually held in specially designed fixtures. The variety of these is limited only by the designer's ingenuity. The essential features are a rigid body which can be bolted to the machine table, some means of locating the part exactly, and an easily operated, quick clamping arrangement.

A few typical fixtures are illustrated. In one, the surface to be milled is located from a bored hole and a fork which fit two carefully machined plugs mounted on an angle plate. In another, a V-shaped piece is located by being held in a large V-block. A third clamps small pieces against an inclined plane for form milling a radius at an angle to a finished surface. Where a series of small pieces are to have a slot milled across them, they are lined up in a box-like fixture. The width of the portion to be milled locates the slot, while supports under the base determine the depth to be cut. Cylindrical pieces are usually mounted on centers. The fixture illustrated was designed to make a series of irregularly spaced longitudinal cuts. A pin fits into the slots of an index plate at one end to locate the cut.



LOCATING WORK FROM PLUGS

V-BLOCK FOR DOVETAIL MILLING

FORM MILLING A RADIUS

INDEXING FIXTURE

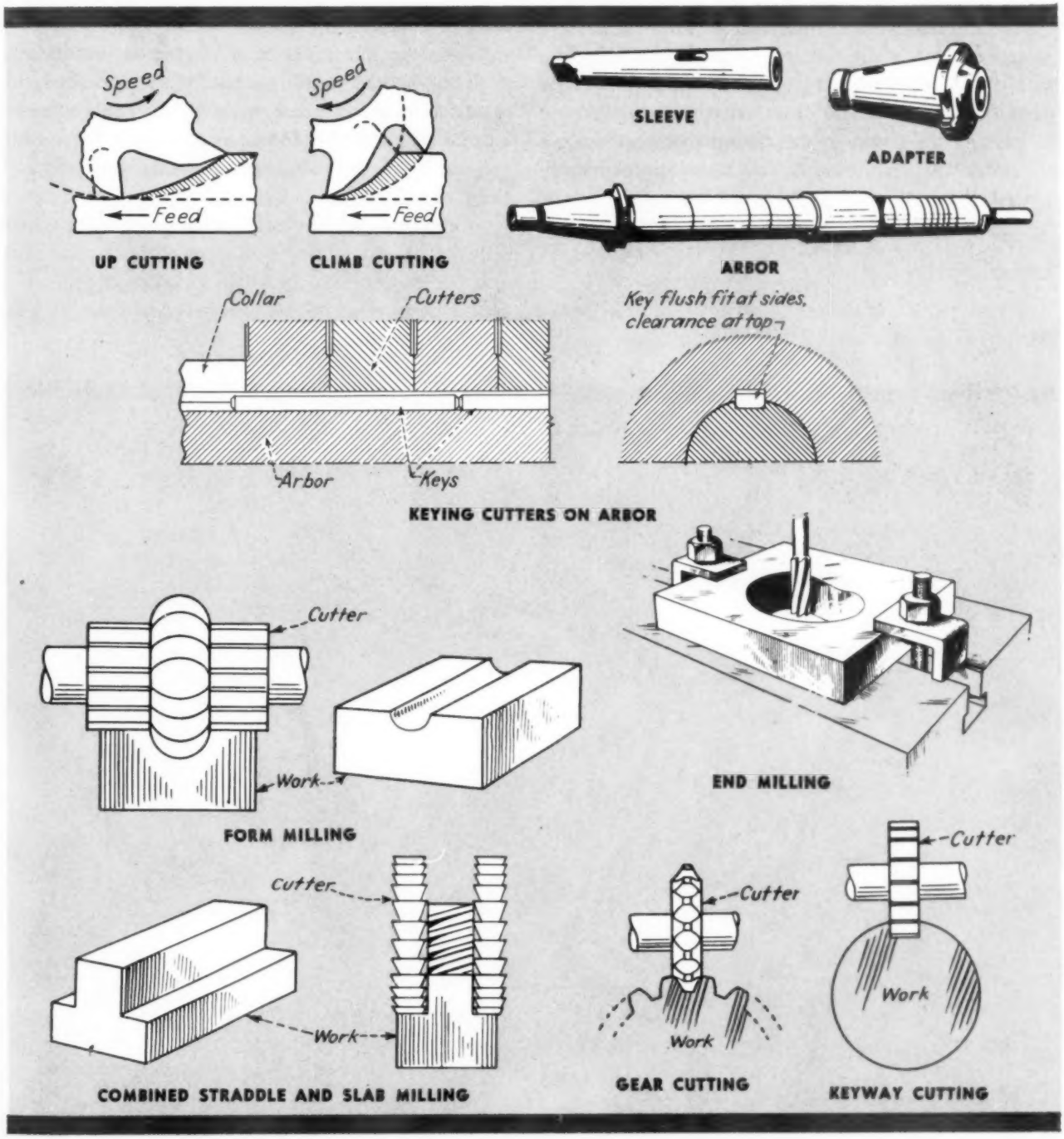
SIMPLE SLOTTING FIXTURE

Since they are usually designed for special machines, fixtures are usually simple to set up. However, the general principles should be followed. The fixture should be centered on the table. The table should be as close to the column as practical. And the alignment should be checked with a square, dial indicator or other means. When the fixture is properly located, it should be cleaned again before the piece is inserted. After each piece is cut, all chips should be brushed or blown from the fixture before a new piece is mounted. No further adjustment should be necessary.

Mounting the Cutters

One of the first things to be decided in making a cutter set-up is what direction the cutters will turn. This may be determined by the way in which the tool will cut — whether it is to be used in climb or conventional milling. In most milling jobs the tooth of the cutter enters at the bottom of the cut and cuts upward. This is called up-cutting or conventional milling. For some jobs, such as metal slitting and milling twist drill flutes, better results are obtained when the tool cuts down into the work. This is called climb- or down-cutting. However, not all machines are designed for use in climb milling. Because of the forces involved, climb milling should never be done on a machine which is not designed for it. Damage to the work and the machine and injury to the operator can be the result.

When the work is properly positioned, the cutters should be mounted on the arbor, which may extend from 10 to 36 in. from the face of the column, the extended part being held by one or more arbor supports. Face and end mills may be mounted on stub arbors which project only slightly from the column. The dimensions and taper of the part of the arbor



that fits the spindle nose have been standardized for various sizes of machines.

Some of the ways cutters may be mounted on the arbor are shown in the illustration. These are only a few of the possibilities. Many other combinations of side and slab milling, or of form milling and some other type could be shown, while many other operations on round stock are possible.

The cutters are keyed on the shaft and collars are fitted over the shaft to hold the cutter in its proper place. These collars are made in varied sizes so that the exact spacing desired may be obtained. When the cutter is positioned properly the nut on the arbor end is tightened.

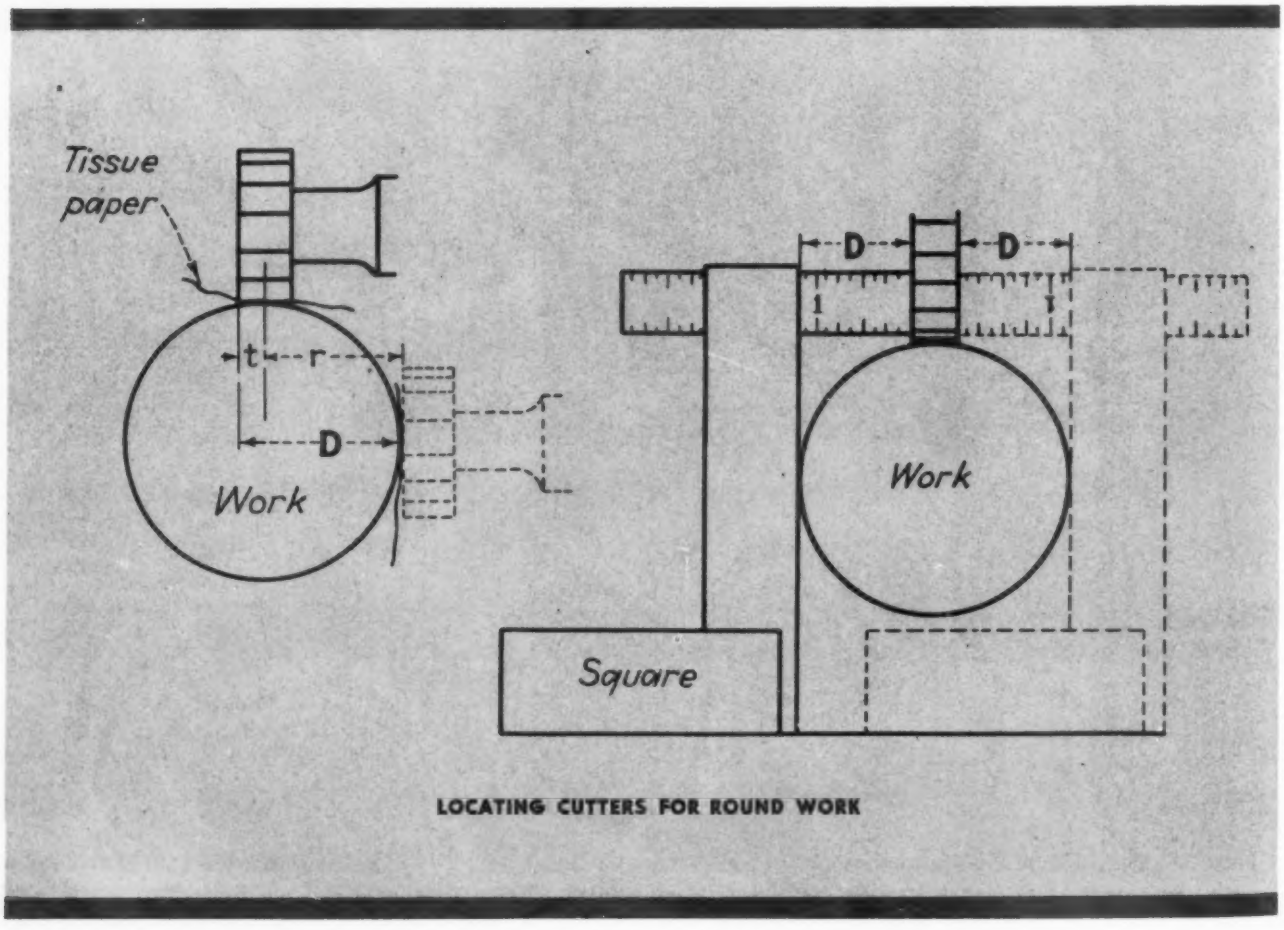
As indicated above, shell end and face mills are fastened directly on the end of stub arbors, while solid-shank end mills are held in adapters. Because of this it is often advisable to vary the set-up routine by placing the cutter in the machine before locating the work. When the work has been approximately placed, the cutter may be removed from the machine to protect it until the job is ready to run.

Locating the Cutters

Set-up blocks are sometimes incorporated in the fixture to aid the operator in finding the proper height and lateral position of the cutter. When these do not exist, height gages, squares, scales or other measuring tools may be used.

When the work to be cut has flat surfaces, the cutters may be located by simple measuring. However, with round work a few elementary techniques are helpful. If the work is moved up to the side of the cutter so that the side of the work is tangent to the side of the cutter, and the work is then lowered and moved towards the cutter a distance equal to half the diameter of the work plus half the thickness of the cutter, the cutter should be centered over the work. If it is impossible to bring the cutter and work into tangency, a machinist's rule and a square can be used as shown in the illustration.

When the job has been accurately set up and has been checked by running a trial piece, it is ready for manufacturing. A great many pieces can be milled from a single set-up. However, the teeth on the cutters become worn in time, depending on the conditions of operation, and the cutter must be removed from the machine and reground. When the cutter is remounted, the entire set-up must be re-examined and the position of the cutters checked with set-up blocks or measuring instruments and by running another trial piece.



LOCATING CUTTERS FOR ROUND WORK

SPEEDS AND FEEDS

BEFORE AN OPERATOR can determine how fast his cutter must turn or how fast the work should be fed to the cutter, he must know:

1. What material is to be milled
2. What type of cutter is to be used
3. How wide and deep the cut must be
4. What finish is desired
5. How rigid the set-up is
6. What power and speed are available
7. What coolant is used and how it is applied.

From manufacturing experience, shop men have determined approximate cutting speeds for the more common materials. These speeds are usually given in surface feet per minute, that is, the speed at which the point of the tooth passes the work. The revolutions per minute for a particular cutter can be found by simple mathematics or from prepared tables.

The accompanying tables give cutting speeds for a selection of common materials and revolutions per minute for a limited number of cutting speeds and cutter sizes. The revolutions necessary to give other cutting speeds can be found easily—for 400 ft. per min., for example, the cutter must run four times as fast as for 100 ft. per min.

Cutters are made of carbon steel, high speed steel, and such materials as Stellite, or with cemented carbide tips. Carbon steel, one of the oldest cutting tool materials, is still used on many light operations. High speed steel serves for a great many medium and heavy duty jobs. Stellite is particularly good for medium and heavy duty work of an interrupted nature. And carbide tipped cutters are adapted to a great many high speed jobs.

The design as well as the material of the cutter influences the speed and feed. Helical teeth have a shearing cut which allows them to cut more freely and with less chatter than straight teeth. Also, the

REVOLUTIONS PER MINUTE

	Surface Feet Per Minute						
Dia.	40	50	60	70	80	90	100
1/4	611	764	917	1070	1222	1375	1528
5/16	489	611	733	856	978	1100	1222
3/8	407	509	611	713	815	917	1019
7/16	349	437	524	611	698	786	873
1/2	306	382	458	535	611	688	764
5/8	244	306	367	428	489	550	611
3/4	204	255	306	357	407	458	509
7/8	175	218	262	306	349	393	437
1"	153	191	229	267	306	344	382
1-1/8	136	170	204	238	272	306	340
1-1/4	122	153	183	214	244	275	306
1-3/8	111	139	167	194	222	250	278
1-1/2	102	127	153	178	204	229	255
1-5/8	94	117	141	165	188	212	235
1-3/4	87	109	131	153	175	196	218
1-7/8	81	102	122	143	163	183	204
2"	76	95	115	134	153	172	191
2-1/4	68	85	102	119	136	153	170
2-1/2	61	76	92	107	122	137	152
2-3/4	56	69	83	97	111	125	139
3"	51	64	76	89	102	115	127
3-1/2	44	55	65	76	87	98	108
4"	38	48	57	67	76	86	95
4-1/2	34	42	51	59	68	77	85
5"	31	38	46	54	61	69	76
5-1/2	28	35	42	49	56	63	70
6"	25	32	38	45	51	57	64
7"	22	27	33	38	44	49	55
8"	19	24	29	33	38	43	48
9"	17	21	25	30	34	38	42
10"	15	19	23	27	31	34	38
11"	14	17	21	24	28	31	35
12"	13	16	19	22	25	29	32
13"	12	15	18	21	24	27	29
16"	10	12	14	17	19	22	24
18"	8	11	13	15	17	19	21

TABLE OF CUTTING SPEEDS
(Surface Feet Per Minute)

	HIGH SPEED STEEL		CARBIDE-TIPPED		
MATERIAL	Rough	Finish	Rough	Finish	COOLANT
Cast Iron	50-60	80-110	180-200	350-400	Dry
Semi-steel	40-50	65-90	140-160	250-300	Dry
Malleable Iron	80-100	110-130	250-300	400-500	Soluble, Sulphurized or Mineral Oil
Cast Steel	45-60	70-90	150-180	200-250	Soluble, Sulphurized, Mineral or Mineral Lard Oil
Copper	100-150	150-200	600	1000	Soluble, Sulphurized or Mineral Lard Oil
Brass	200-300	200-300	600-1000	600-1000	Dry
Bronze	100-150	150-180	600	1000	Soluble, Sulphurized or Mineral Lard Oil
Aluminum	400	700	800	1000	Soluble or Sulphurized Oil, Mineral Oil and Kerosene
Magnesium	600-800	1000-1500	1000-1500	1000-5000	Dry, Kerosene, Mineral Lard Oil
SAE Steels					
1020 (coarse feed)	60-80	60-80	300	300	Soluble, Sulphurized, Mineral or Mineral Lard Oil
1020 (fine feed)	100-120	100-120	450	450	" " "
1035	75-90	90-120	250	250	" " "
X-1315	175-200	175-200	400-500	400-500	" " "
1050	60-80	100	200	200	" " "
2315	90-110	90-110	300	300	" " "
3150	50-60	70-90	200	200	" " "
4340	40-50	60-70	200	200	Sulphurized and Mineral Oils
Stainless Steel	100-120	100-120	240-300	240-300	" " "

Note: Feeds should be as much as the work and equipment will stand, provided a satisfactory surface finish is obtained.

fewer teeth in contact with the work at any time the less pressure on the cutter. Hence, coarse tooth cutters operate under less stress than fine tooth cutters. They have the added advantage of more space between teeth for chip removal.

The nature of the cut is important since heavy cuts must be run slower than light ones, and deep slots, in which heat accumulates rapidly, must be cut slower than shallow ones. Roughing cuts are usually made with slower speeds and heavier feeds than finishing cuts.

As the milling cutter bites into the work, it generates a great deal of heat. This heat must be carried away or the work will be distorted and the tool edge ruined. Therefore the work and tool should be flooded with some sort of cutting fluid or coolant. This will also prevent undue friction, improve the finish, flush away chips, prevent corrosion and permit faster cutting speeds.

Suggested coolants for various materials are given in the cutting speed table. However, if the cutting fluid for your particular piece is not given on the job sheet, consult your foreman. The chief precautions in the use of cutting fluids concern cast iron and magnesium. Because of the abrasive action of wet cast-iron chips, this material is always milled dry. Because magnesium chips and water make an inflammable mixture, only straight cutting oils should be used in milling it.

TIPS FOR OPERATORS

BE SURE YOU UNDERSTAND your instructions clearly before starting work.

Once started, do not stop a cut except in case of an accident. The tool will undercut when it is started up again.

Make sure there is no backlash in feed screws when hand feeding to precise dimensions. When it is necessary to back the work out, back two or three turns before advancing the work again.

Stop the machine before changing speeds. Otherwise you may strip the gears.

Keep the outboard bearing of the arbor well lubricated to prevent it freezing on the arbor.

Cutters should fit the arbor snugly. Loose fits are inaccurate. Drive fits may mar the arbor.

Use the smallest cutter that will do the job. Time may be wasted in waiting for large cutters to run through the work.

Change cutters when they become dull. The finish may be spoiled, production time wasted, and the cutter damaged by running it dull.

Use arbors that are as short and as large in diameter as practicable. The more rigid the set-up the better.

Do not remove shell end mills or face mills from their arbors when they need grinding. It is impossible to remount them just as they were.

In clamping work, use only enough pressure to hold the piece firmly. Overtightening may spring the work or mar the table T-slots.

A piece of paper placed between the work and the table will help prevent the work from slipping.

Direct coolant at the point where the cutter enters the work so that it will be carried by the teeth up to the cutting point.

Keep foreign matter out of coolants. Dirty cutting fluids can be a source of infection for the operator.

Two 16-page sections of our series of training aids for wartime industry have already been published. The first, The Tools of Our Trade, was a picture dictionary of common machine shop tools. It appeared February 18. The second, How to Run a Drilling Machine, introduced the new employee to drill press work. It appeared April 15. Future sections are planned on turning and grinding operations. Reprints of these articles will be available as they appear from the Editor, AMERICAN MACHINIST, 330 West 42nd St., New York, N. Y., at 10 cents a copy (less in lots of over 500).

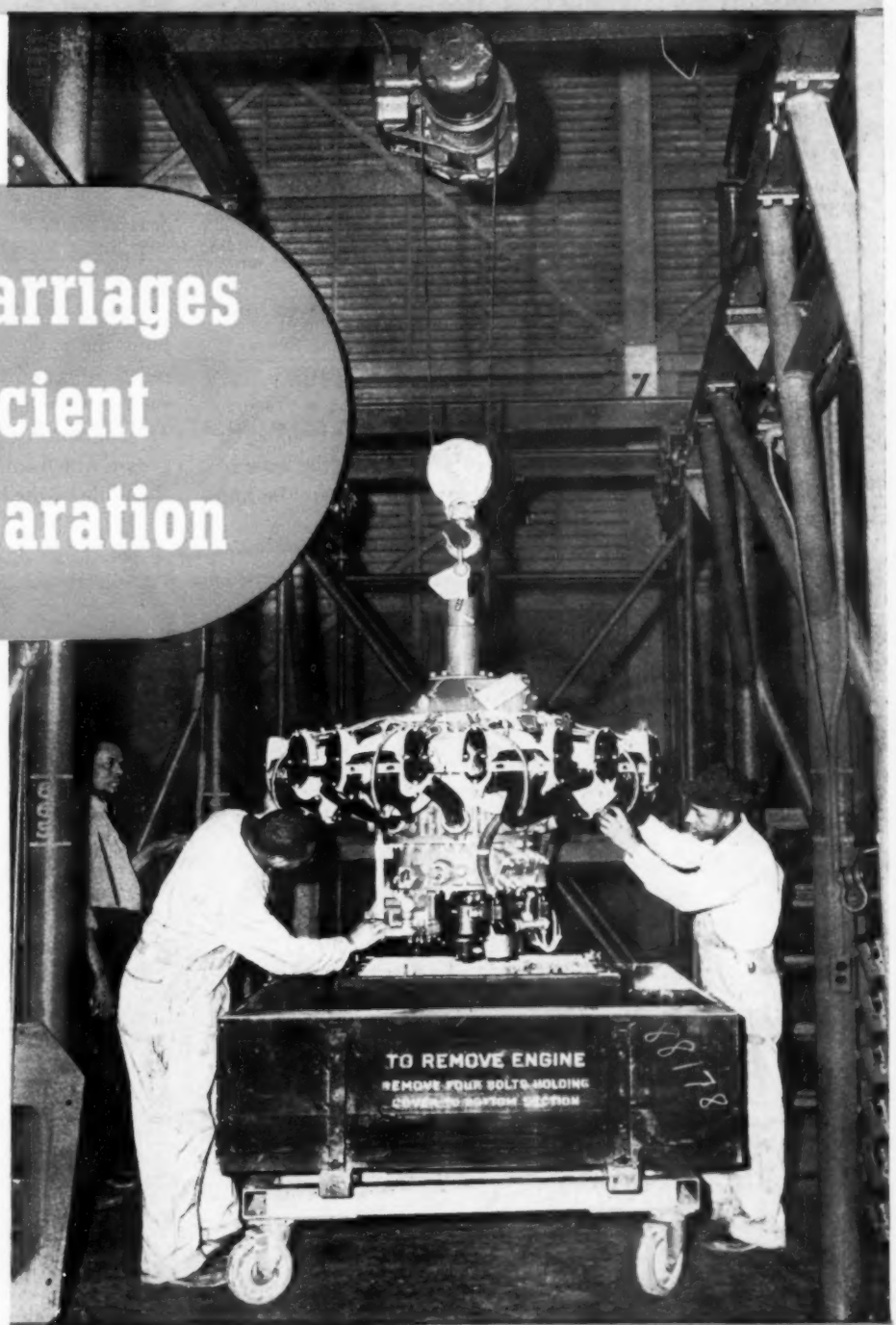
In preparing this section we have had the advantage of information and illustrative material supplied by the following manufacturers:

American Brass Co.
Brown & Sharpe Manufacturing Co.
Carboloy Co., Inc.
Cincinnati Milling Machine Co.
Firth-Sterling Steel Co.
The Frew Machine Co.
Illinois Tool Works
Kearney & Trecker Corp.
The National Acme Co.
W. H. Nichols & Sons
Pratt & Whitney Div., Niles-Bement-Pond
Van Norman Machine Tool Co.
The Warner & Swasey Co.

Armament

SECTION OF AMERICAN MACHINIST

Overhead Carriages Provide Efficient Engine Preparation



The engine is removed from its shipping box by an electric hoist. Note the triangular transfer plate for shifting it to the conveyor carriage

NO PART of an airplane needs more care than the engine—in its manufacture and in preparing it for mounting on the ship. The process of preparation is done in the airplane builder's plant in a separate department arranged for the purpose. One of the best set-ups designed for this work is to be found at the Tulsa Plant of the Douglas Aircraft Company.

Engine preparation includes cleaning, testing and the installation of all parts and subassemblies required to make the power units ready for flight. At Tulsa some 600 subassemblies are made up and put into place in a department arranged to handle engines for the Liberator (B24) heavy bomber and the Dauntless (A24) dive bomber. The department is fully conveyorized and provided with carriers designed to handle engines for these two ships; however, the lines may be adapted to other engines.

Engines are stored in their ship-

By C. C. WHITLACH, *Supervisor, Engine Preparation, Tulsa Plant, Douglas Aircraft Company*

ping boxes until ready for the preparation line. The box is placed on a dolly, rolled under a fixed hoist and the lid is removed. The shipping plate by which the engine is bolted to the box is left on the engine.

A hub carrying a lifting pin is screwed to the end of the propeller shaft. A transfer plate has been designed, which consists of a triangular piece of steel with three holes drilled in it. Normally one hole is connected to the lifting pin, while another hole is used for attaching the plate to the hoist by means of a shackle. The third hole comes into use when transferring the engine from one lifting device to another.

The engine is hoisted from the box and transferred to a swiveling carrier which is slung from a two-track overhead trolley. It is attached to this carrier by means of four bolts through the shipping plate which enables it to be rotated in a vertical plane.

When received, the engine is coated inside and out with heavy grease to protect it from corrosion. This coating must be removed before any other work is done.

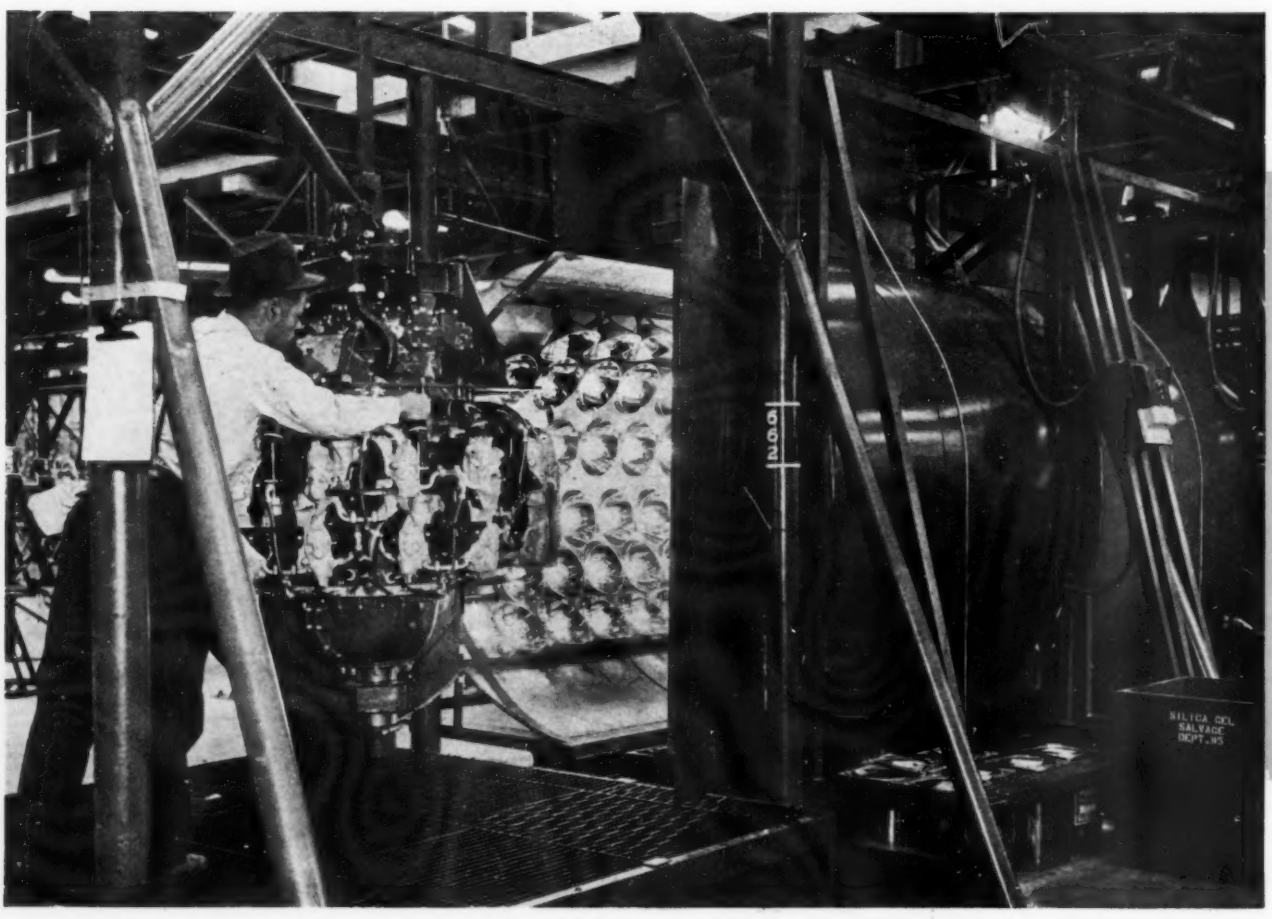
The engine is rolled on its carrier over a grating-covered sump where all plugs are removed. A little of the grease drains off, but it is so viscous the amount is small. A bar is placed through a hole in the hub to rotate the propeller shaft by hand until the intake valve on bottom cylinder is opened. This point can be determined by temporarily removing the cap from the magneto as its position indicates the valve openings. The intake valve is opened on the bottom cylinder to allow the oil to drain out of the impeller section through the bottom cylinder spark plug holes while the engine is in the flight position in the heat booth.

Grease Softened by Radiant Heat

The engine is then rolled along the trolley into a booth banked on either side with infra-red lamps. The lamp banks may be moved inward and outward on rollers to accommodate different sizes of engines. They work best when the lamps are about 10 in. from the nearest surface.

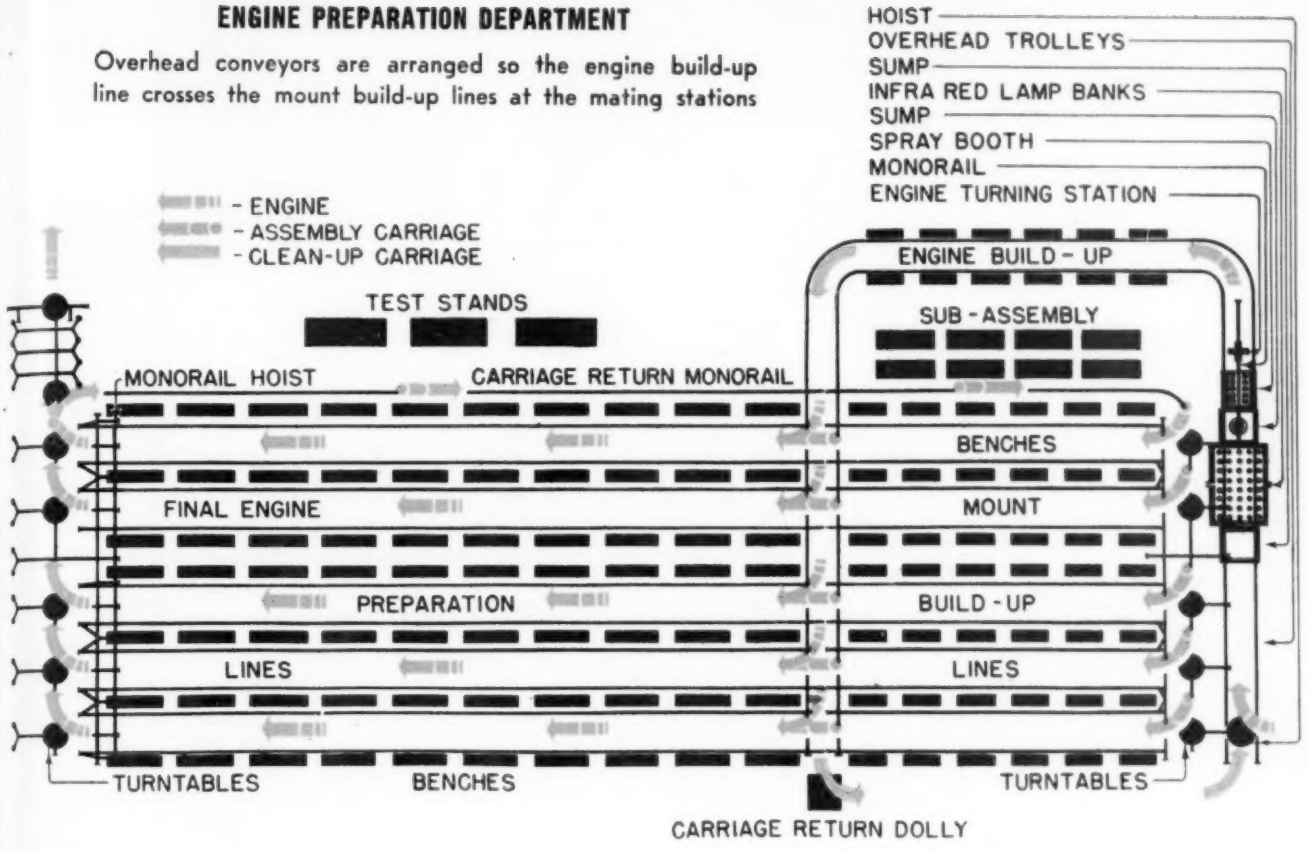
Engines are kept in the booth 80 min.; 40 min. nose down, 20 min. in flight position and 20 min. again in nose-down position. Since the shipping plate, which joins the engine to the swiveling carrier, is near its center of gravity, the engine's position is readily adjusted. The movement of the engine has been found by experience to give the best drainage of the slushing grease which softens as the temperature rises.

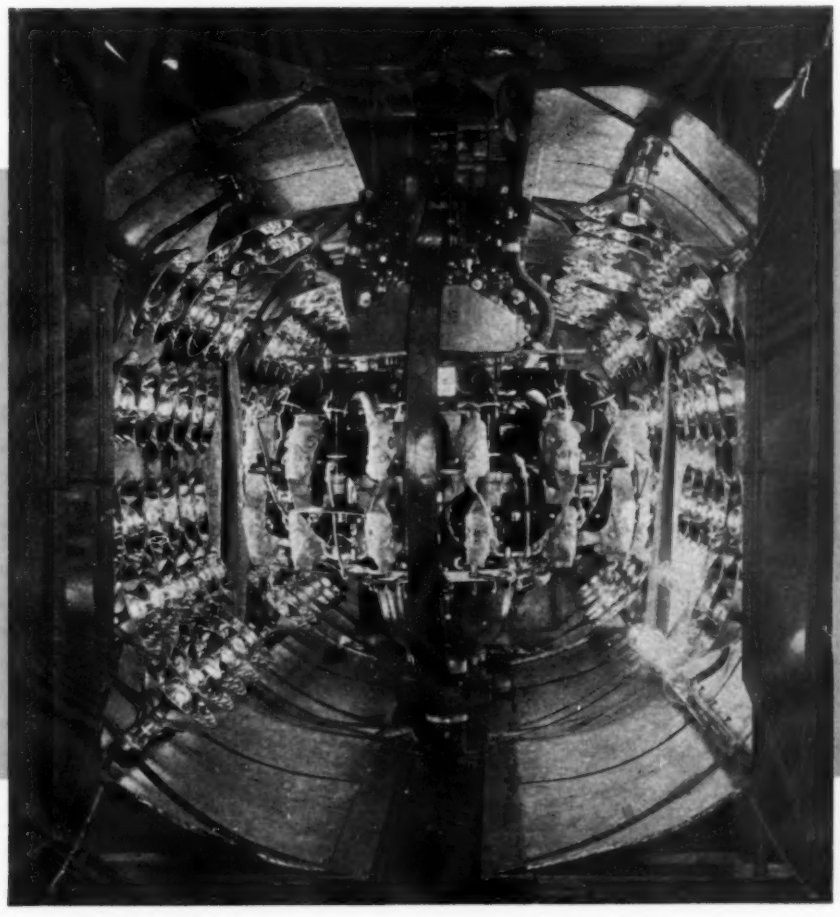
While in the booth the engine temperature increases



ENGINE PREPARATION DEPARTMENT

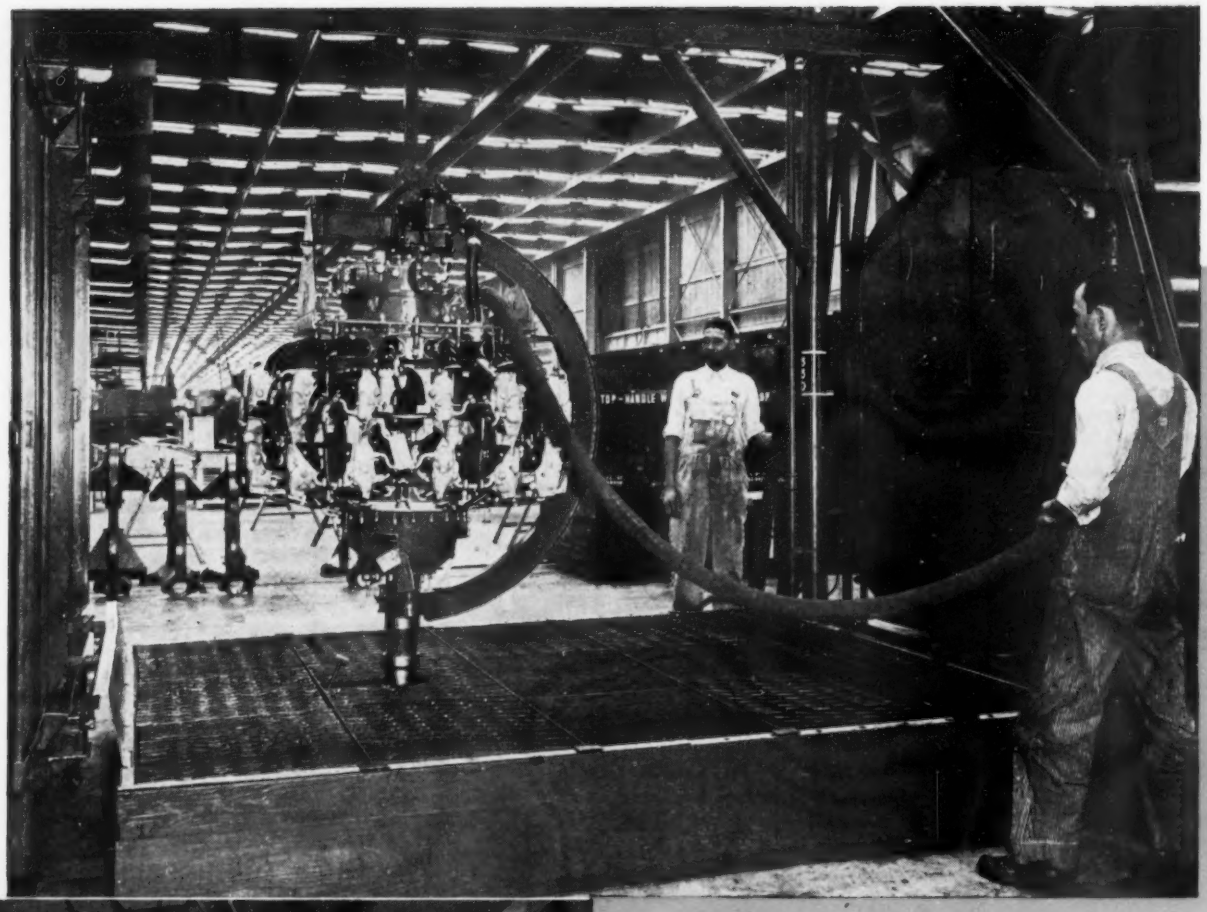
Overhead conveyors are arranged so the engine build-up line crosses the mount build-up lines at the mating stations



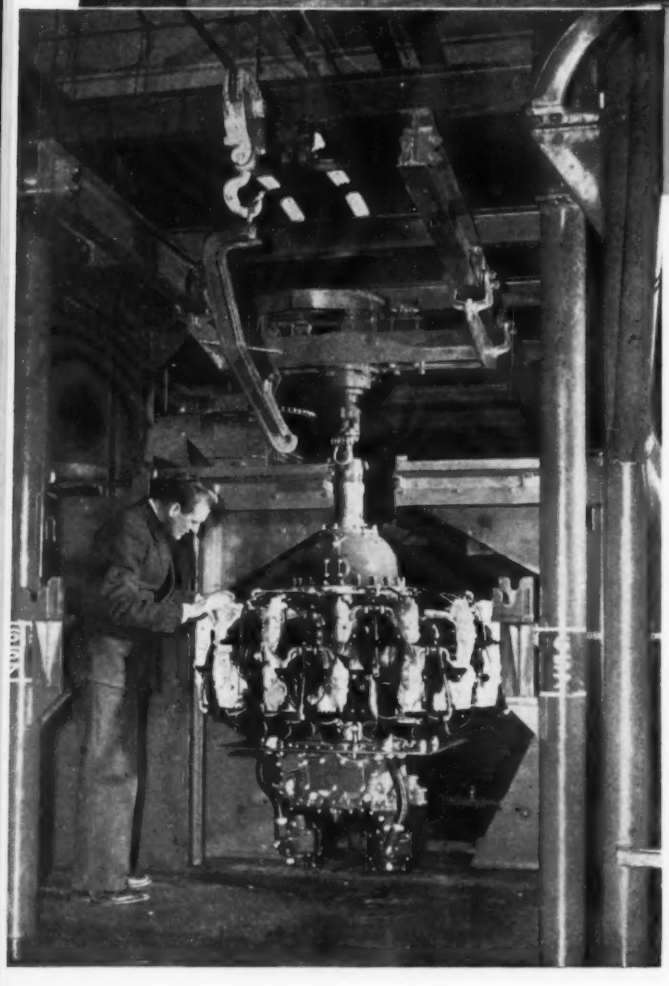


Before rust-preventative coatings can be removed they must be softened by heat. An infra-red booth does the job effectively

Inside the booth the angular position of the engine is changed according to a planned schedule; this is the nose-down position. Booth walls may be moved to accommodate various sizes of engine



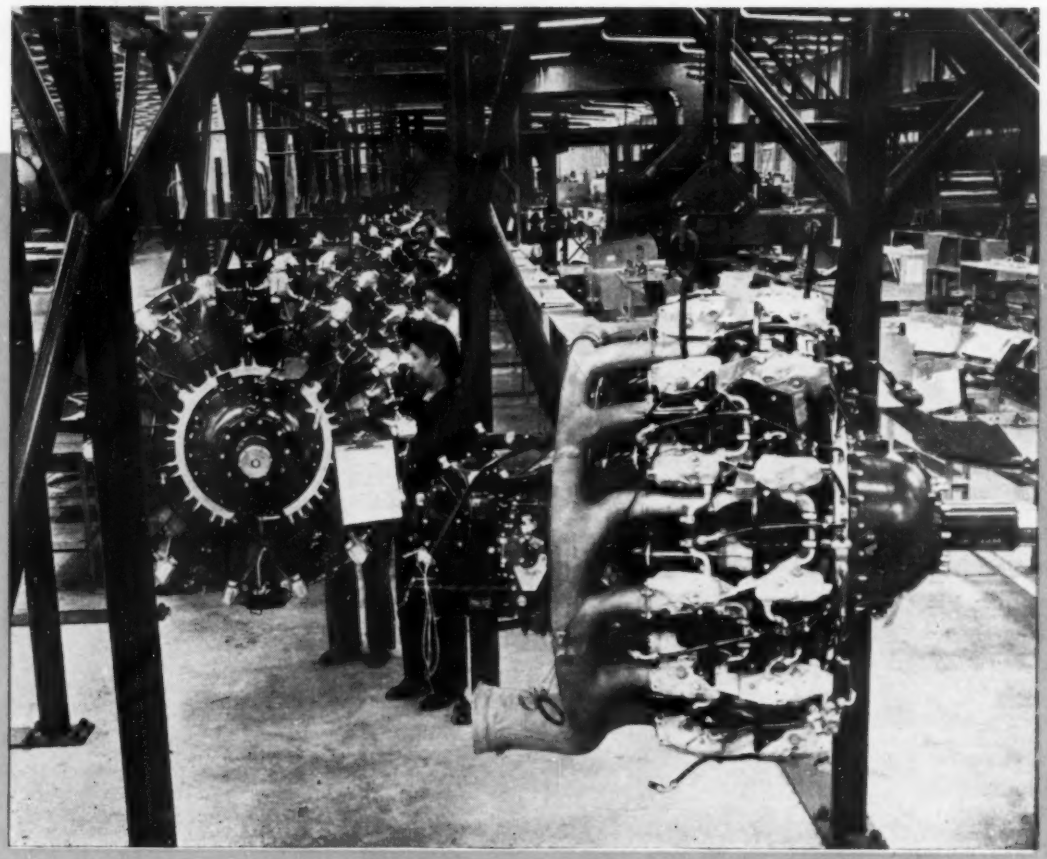
After leaving the radiant-heat booth, the engine has air blown through it while the crankshaft is driven from below. This cleans the innards thoroughly



External cleaning is done in a wash booth with the engine revolving nose up. Solvent is sprayed on and then blown off by an air blast. The overhead hoist brings the engine to flight position after cleaning

to 140-150 F. Careful inspection has shown that this rise in no way impairs the insulation on the ignition wiring. When heat is applied by methods other than infra-red radiation, the period of time necessary to reach the proper temperatures to remove the compound would be too great for production efficiency.

The engine is rolled on its overhead trolley over another sump where the blower cover is removed and replaced with a tight plate having an air hose connection. With the engine positioned nose down, a cross-slot in the end of the propeller shaft engages a key in a vertical shaft flush with the sump grating. By means of this device the propeller shaft may be rotated using an electric motor for the driving power. An air hose connects the cover plate to a nearby line which is provided with a water trap to remove the



In the build-up line all engine assembly is completed that can be done prior to mating

moisture. While the engine is rotated, the dry compressed air is forced through the cylinders to blow the remaining heated grease out through the spark plug holes.

With the internal cleaning completed the engine is pivoted to nose-up position and is transferred from the swiveling carrier to a power-rotated hook suspended from a monorail hoist. Protek plugs are put back into the spark plug holes; sump strainers and sump plugs are restored.

Outside Cleaned by Solvent

The engine is rolled along the monorail into a cleaning booth one side of which is equipped with a bank of spray nozzles and the other side with three air jets.

Using an electric motor with suitable gearing, the engine is spun for 2 min. while solvent is sprayed on it at the rate of 350 gal. per min. The solvent is then shut off, and the air blasts are turned on for 10 min. to complete the engine cleaning.

Engine manufacturers have recently begun to omit the heavy slushing grease and to protect the engines instead with Pliofilm bags. Shipped this way, engines do not need cleaning, which makes heating and spraying unnecessary.

Engines leaving the spray booth are returned to flight position by attaching a cross yoke to the shipping plate and lowering the nose with the electric hoist. A sling carried in the overhead double-track trolley is attached to the engine at three points where shackles have been provided during its manufacture.

This support gives a slightly nose-down position which levels off when parts and accessories are added. A thin vertical steel strap joins the sling to the overhead trolley.

The engine is moved by hand through seven work stations which constitute the engine build-up line. At present all the engine preparation lines are manually operated but provision is made to drive them by power if it is thought desirable. In this line, and in succeeding lines, electric and compressed air outlets are provided at each work station, and a row of work tables parallels the line on either side.

Work done along the engine build-up line includes installation of eight flexible engine-mount connections

using a jig to position them accurately. Baffles, collector rings, manifolds, propeller governor line brackets and other subassemblies are put into place.

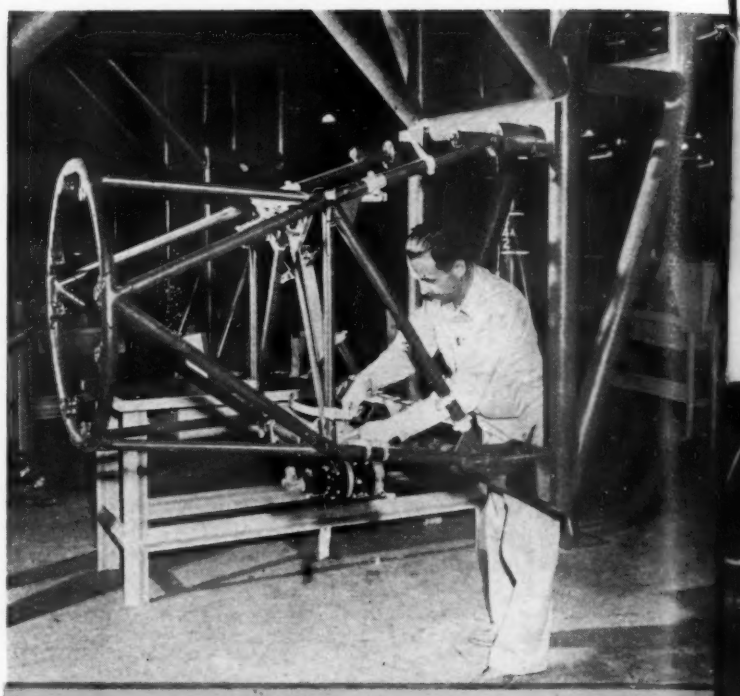
At the end of this section of the line the conveyor takes a right angle turn and cuts across the engine mount lines. The vertical steel strap holding the engine sling passes through hinged and counterbalanced sections of the mount line trolley tracks.

There are five mount lines in all, four of which carry the mounts for a Liberator bomber while the fifth carries mounts for the single-engine dive bomber. Mounts and engines are mated at the intersections of these lines with the engine build-up line.

Photos Help Subassembly

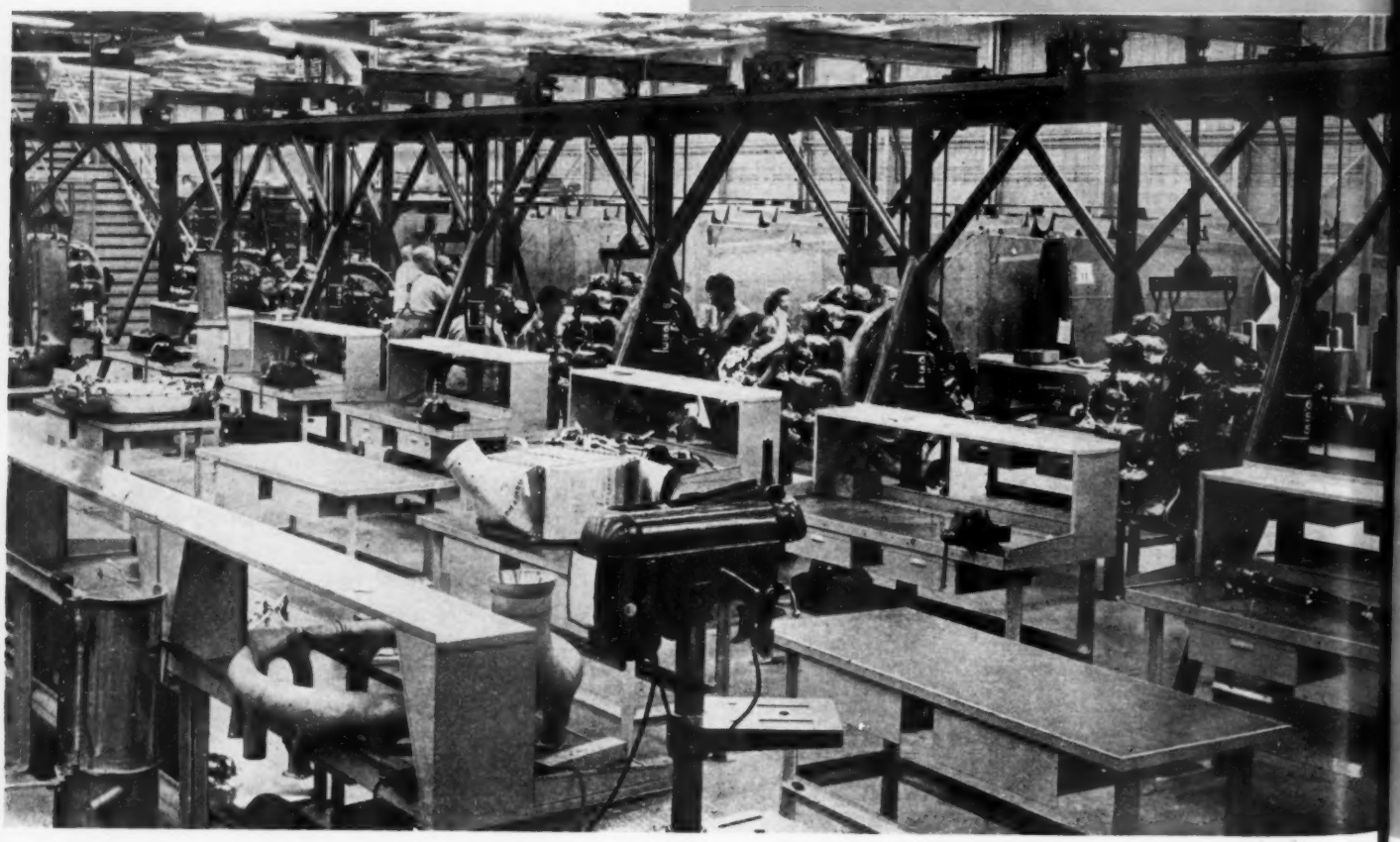
The floor area between the engine build-up line and the first mount line is occupied by benches devoted to subassembly work. All work possible is done on these benches rather than on the lines. Subassemblies may be extremely simple, such as a length of tubing with a couple of connections attached, or very complicated. Books with printed and photographic instructions show every step of the 600 subassemblies so inexperienced operators may learn their duties quickly.

Before they reach the intersection of the engine build-up line, the mounts have already progressed through five work stations. All work that can be done on the mount before attaching the engine is completed at these stations just as all work that can



This is the start of engine mount build-up—a separate line from the engine build-up. A rigid carriage supported on overhead tracks gives excellent accessibility

The area in the foreground is used for bench work on subassemblies. The engine build-up line is in the background



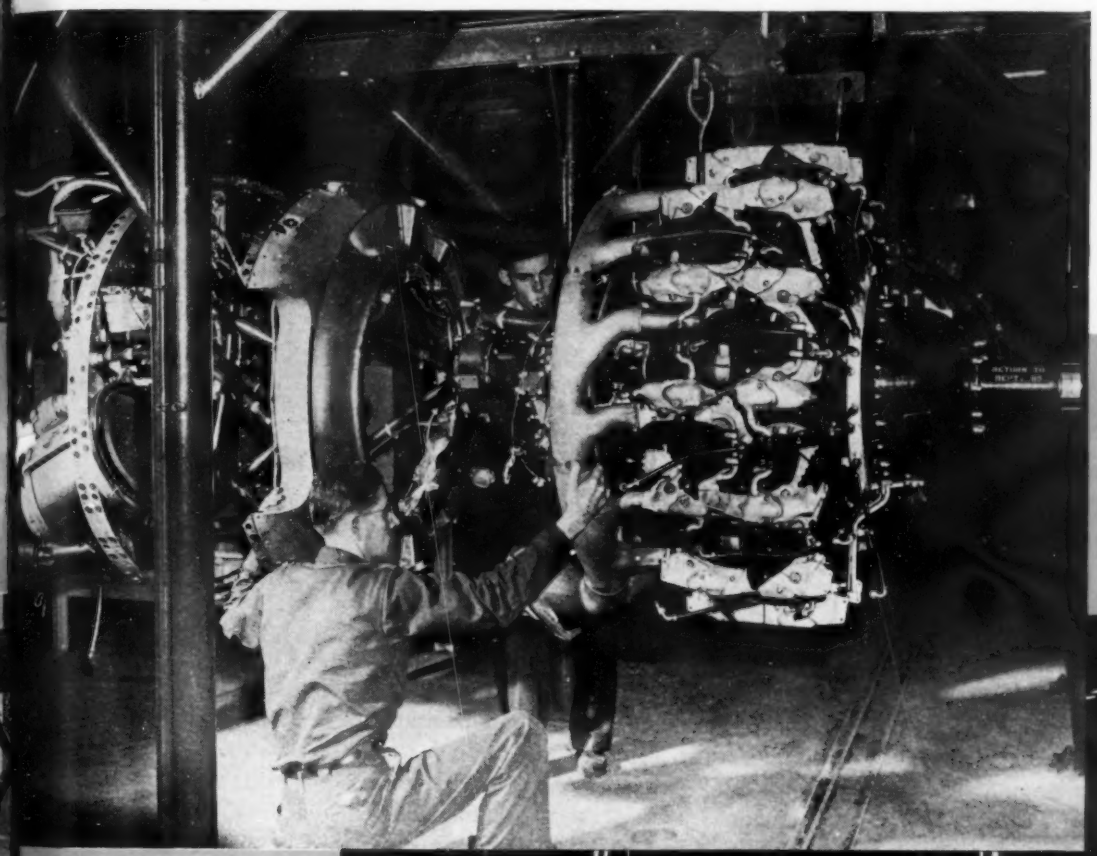
be done on the engines without the mount is performed on the engine build-up line.

A special carrier of heavy cross-braced sections of tubing carries the mount before and after the engine is added. It rolls on a four-wheeled trolley carried on two overhead tracks and may be locked at each work station by passing a pin through a hole in one of the wheels into the carriage frame.

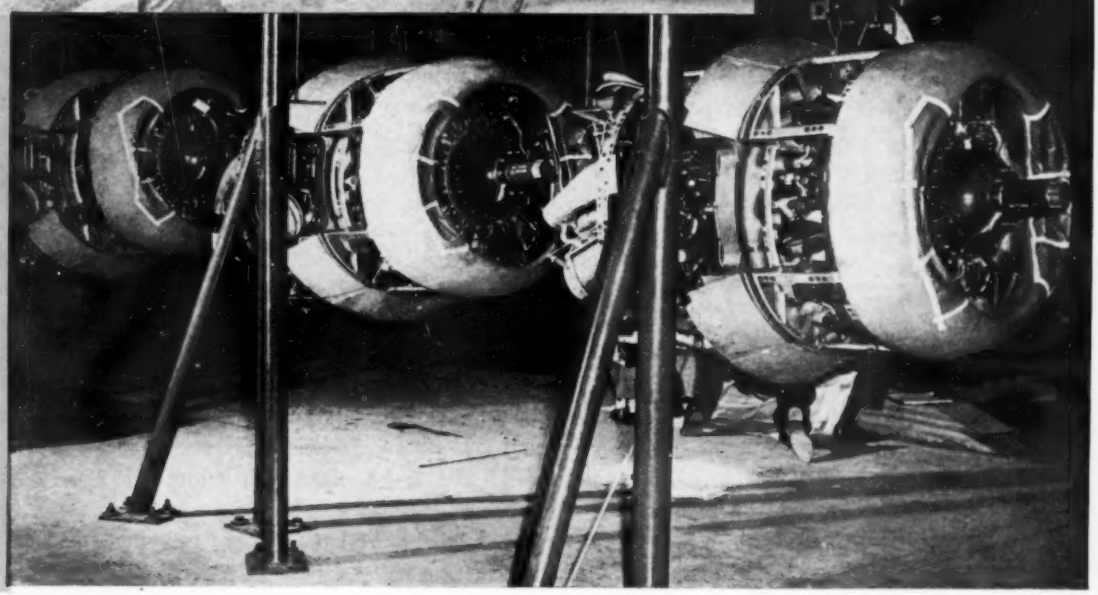
In the mount build-up line, the oil tank assembly, the oil cooler, the inner cooler and the diaphram are installed. Tool racks along the line, together with the work tables, bring all needed material within easy reach of the assemblers. Similar equipment is used in the final lines, extensions of the mount build-up lines.

The mount and engine meet at the correct height at the mating points. A vertical adjustment of the carrier facilitates the transfer of the engine from its own trolley to the mount. The freed engine trolleys continue straight across the last mount line where they are stopped by automatic safety locks. A four-wheeled high dolly, which is moved into position to receive the trolleys, has two lugs which trip the locks at the end of the track and permit the trolleys to roll on the dolly. Four of them can be carried at a time to the starting station to commence a new cycle.

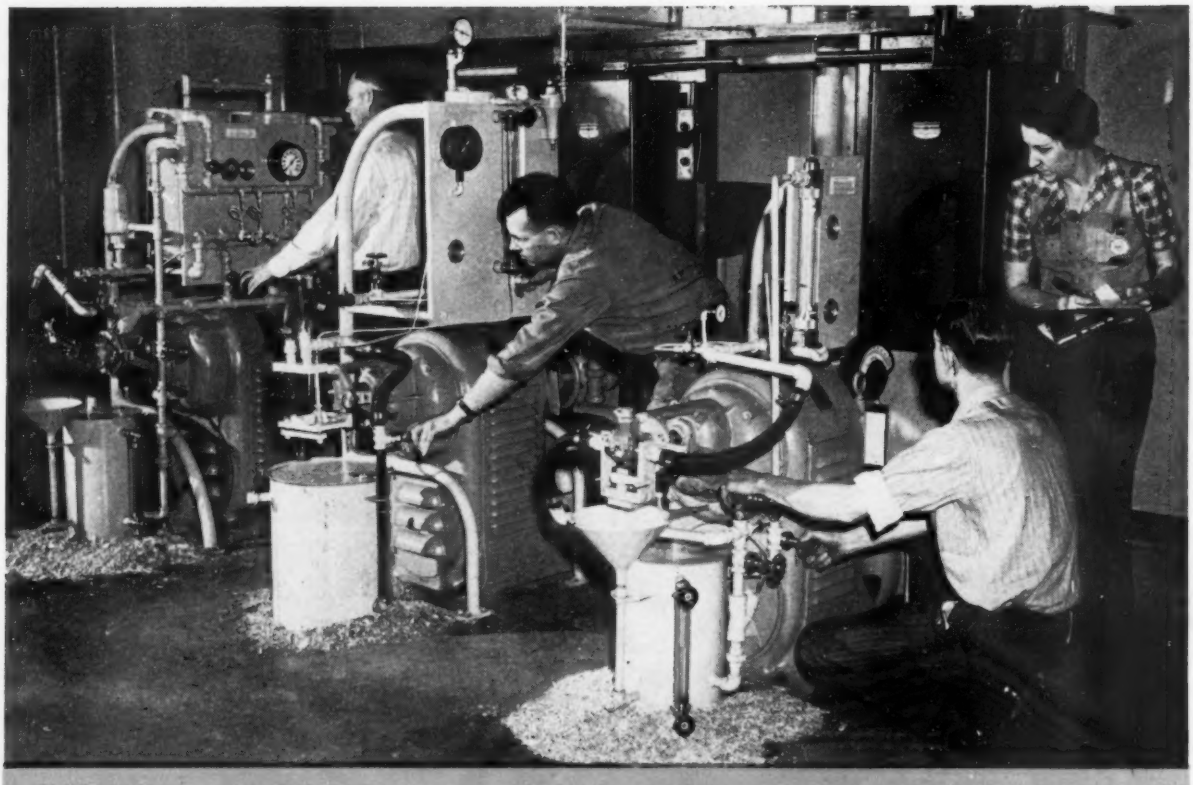
Engines and mounts are carried together through



The engine and mount are "mated" where the two lines cross. Pivoted segments in the mount tracks permit engine carriers to cross them



Completed engines are taken from the final preparation lines on a monorail before they are sent to the bomber assembly departments on dollies



Test stands are used to check the hydraulic, vacuum and fuel pumps respectively (left to right). The inspector at the right records the test readings and seals the adjustments before the units are installed

ten stations in the last section of each line where operations are performed that cannot be done on the two separately.

Along the final part of the line the carburetor, flap ring, crank extension and air ducts are installed.

Electric connections, fuel lines, oil lines and vacuum lines are hooked up. Cowling is fitted, stenciled with the engine number and removed to a dolly where all its sections for a single ship are carried to the final assembly line to be put back into place after the engines are mounted on the ships. An electric rectifier plugs into a 110-volt line to supply the low-voltage current needed to test and adjust the electrically operated flaps.

Transferred to a Monorail

A monorail hoist cuts across all five of the engine preparation lines at the final station. The hoist takes the weight off the four bolts which hold the assembly to the carrier. The bolts are removed, and the combined engine and mount are transferred by a sling to a monorail conveyor. Turntables switch the assemblies to a right angle monorail along which they are rolled. When over a floor dolly, they are lowered, unhooked and carried to the final airplane assembly.

The same monorail is used to return the engine mount carriers back to the beginning of the mount build-up line. In addition to the four wheels on which they roll through the work stations, each carrier has a center bracket with wheels to fit the monorail. Instead of following the engines along the monorail, the carriers are switched by another turntable to a back-track which parallels the assembly lines. At the start of the line this track makes a right angle turn. This section of the track has more turntables so that any carrier may be started down any line.

Test stands for important engine units are provided to insure their correct operation before installation. One stand checks the fuel pumps and measures the flow at varying speeds. Another serves to inspect vacuum pumps by gaging the amount of suction and the rise in temperature. Still another stand checks hydraulic pumps at pressures up to 1,000 lb. per sq. in. and measures the flow of oil at this pressure. Another device gives every carburetor a thorough operational test before it is attached to the engine.

Thus both insurance against failure and ease in handling are combined in Tulsa's engine-preparation department.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Arc Welding Faults and Corrections—I

BY C. H. JENNINGS, WELDING ENGINEER, WESTINGHOUSE ELECTRIC & MFG. COMPANY

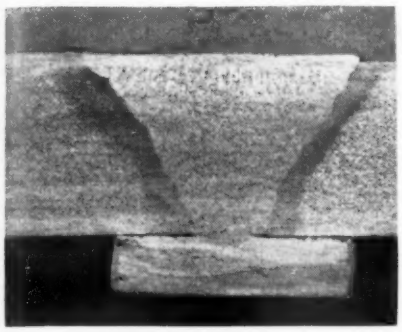


Fig. 1—Complete fusion

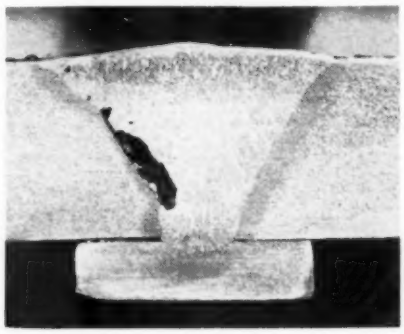


Fig. 2—Poor fusion and inclusions

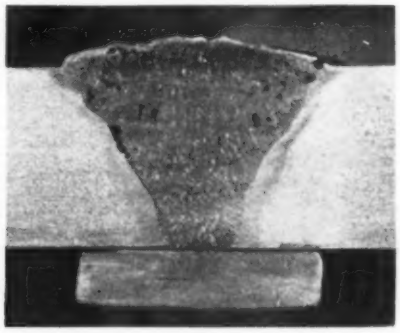


Fig. 3—Porous butt weld

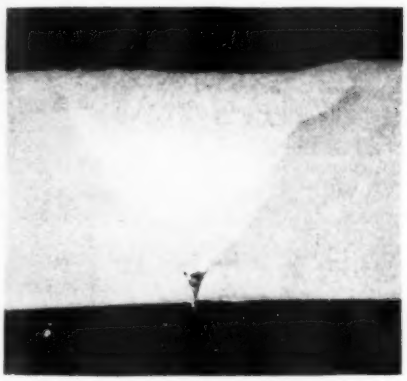


Fig. 4—Incomplete penetration

Fig. 5—Ductile and brittle joints

GOOD BUTT WELD, FIG. 1

For purposes of comparison with the poor welds illustrated, this weld shows complete fusion and penetration. These qualities are obtained by observance of such factors as: proper preparation of the joint, electrode diameter, welding current, welding speed, weaving of the electrode, and the use of a back-up bar where possible.

POOR FUSION, FIG. 2

CAUSES—Low welding current and improper weaving procedure (illustrated); also improper electrode diameter, preparation of joint and welding speed.

CORRECTIONS—(1) Use electrode small enough to reach bottom of the V, (2) for a given electrode, current increases with plate thickness to deposit metal and pentrate the plates, (3) weaving should be wide enough to melt sides of the joint, and (4) deposited metal should sweat onto the plates, not curl away from them.

POROSITY, FIG. 3

CAUSES—Illustrated porosity brought about by short arc and insufficient puddling, but the condition also arises from poor base material and inherent properties of some electrodes.

CORRECTIONS—(1) do not hold too short an arc, (2) puddling keeps the metal molten longer, gives time for entrapped gas to escape, (3) pinholes are often contained in a weld made of a series of strung beads; weaving often eliminates this trouble, (4) avoid excessive welding current, (5) check electrodes for type, and (6) examine base material for segregations.

INCOMPLETE PENETRATION, FIG. 4

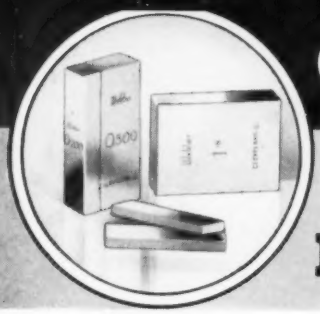
CAUSES—Improper preparation of joint, use of too large an electrode, insufficient welding current, and too fast a welding speed.

CORRECTIONS—(1) allow proper free space at bottom of weld, (2) use small diameter electrodes in narrow groove; do not expect excessive penetration from an electrode, (3) use sufficient welding current for proper penetration, but do not weld too rapidly (4) if possible, use a back-up bar, and (5) chip or cut out the back of the joint and deposit a bead.

BRITTLENESS, FIG. 5

CAUSES—Air-hardening base metal, improper preheating, unsatisfactory electrodes.

CORRECTIONS—Preheating of medium-carbon and certain alloy steels at 300-500 F. offsets the tendency of the heat-affected zone to become hard as the result of rapid cooling, (2) multiple-layer welds tend to anneal hard zones, (3) annealing at 1100-1200 F. after welding will generally soften hard areas formed during welding, and (5) Austenitic electrodes are



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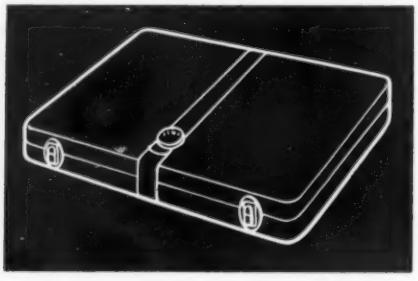

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WIPE GAGES BEFORE USING

Upon receipt of the gages the blocks should be wiped off with a soft cloth dampened with a few drops of Kerosene to remove corrosion resisting compound in which they are packed. Next wipe off the tray in which gages are packed.

CARE OF BLOCKS AFTER USING

After using the gages wipe them with a clean dry cloth all over. Hold the gage in such a manner that the hands never come in contact with the block. When returning gage to box do not touch the gage with your bare hands.

Always place the block into its proper place with the wiping cloth shielding the gage from your fingers or hand. If these precautions are taken it is

not necessary to apply any oil or grease to prevent gages from corroding.

PROCEDURE FOR STORAGE OR INFREQUENT USE

However, if gages are to be stored or out of use for some time, they should be wiped all over with a small, soft cloth dampened with Webber Gage Lubricant to prevent corrosion. Use the same procedure of handling as before—keep cloth between gage blocks and hands while placing them in box.

Webber Gage Blocks are made to .000004 of an inch and have qualities of wear resistance to withstand shop use, however the precautions quoted above should be closely adhered to when handling and using these precision units.

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Webber GAGE COMPANY

12901 TRISKETT RD., CLEVELAND, OHIO

Arc Welding Faults and Corrections—II

sometimes desirable on air-hardening steels; the increased weld ductility compensates for the brittleness of the heat-affected areas in the base metal.

ARC BLOW, FIG. 6

CAUSES—Magnetic fields force the arc to blow away from the point at which it is directed, particularly at the ends of joints and in corners when welding with direct current.

CORRECTIONS—(1) Place the ground in the direction of arc blow, (2) separate the ground in two or more parts, (3) weld toward the direction of arc blow, (4) hold a short arc, (5) change the magnetic path around the arc by using steel blocks, or magnetic shunts, as in Fig. 7, and (6) use a-c welding.

UNDERCUTTING, FIG. 8

CAUSES—Excessive welding current, improper manipulation of electrode, and attempting to weld in a position for which the electrode is not designed.

CORRECTIONS—A good fillet weld with complete penetration, flat face and no undercutting is secured by observing these precautions: (1) use a moderate welding current and do not travel too rapidly, (2) do not use too large an electrode; if the molten-metal puddle becomes too large, undercutting may result, (3) excessive weaving causes undercutting, (4) if the electrode is held too near the vertical plane when making a horizontal fillet weld, undercutting may be obtained on the vertical plate.

DISTORTION, FIG. 9

CAUSES—Angular distortion of a single-V butt joint not properly prepared or clamped is obtained, as illustrated, by shrinkage of deposited metal, nonuniform heating of the parts and improper welding sequence. Maintenance of proper dimensions is impossible.

CORRECTIONS—(1) properly clamp or tack parts to resist shrinkage, (2) preform parts to compensate for weld shrinkage, (3) distribute welding to avoid localized overheating; preheat heavy structures, (4) removal of rolling or forming strains before welding is helpful, and (5) develop a definite welding sequence from a study of the structure.

(To be continued)

Fig. 6—Arc blow at end of joint

Fig. 7—Shunt controls arc blow

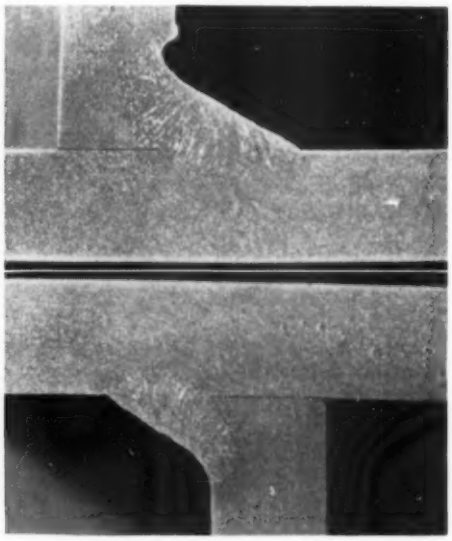

Fig. 8—Undercut and good fillet welds

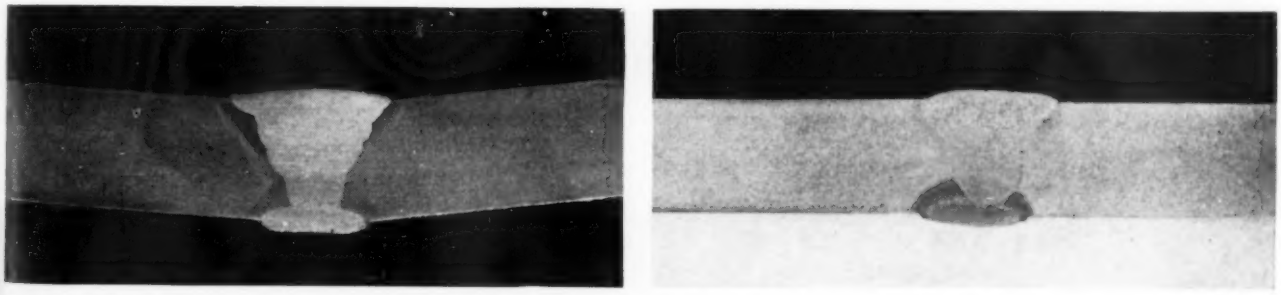

Fig. 9—At left, angular distortion of improperly prepared joint; at right, proper clamping avoids distortion

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Stop Acting in Haste

A TOP government war agency recently asked its advisory group, consisting of eight nationally known men, for its opinion regarding the desirability of issuing immediately a sweeping directive seriously affecting an industry employing over half a million men.

The agency had not previously studied the possible effect of the directive upon the industry. No crisis had arisen overnight demanding quick action. The move appeared to be political; the economics of the situation hardly justified the proposed course.

The advisory group voted six to two in the negative. It suggested careful study of the matter and affirmative action in due time if mature judgment seemed to dictate it.

But the administrator chose to brush aside his advisers and hastily issued the directive. It stirred up plenty of trouble and the administrator had to modify his stand.

That case is not uncommon. We remember the hurry with which the War Production Drive, sponsored by management-labor committees, was conceived and begun by the War Production Board. It gave many people the impression that here was another cunning device of a labor-minded government to help unionize industry.

Nothing was farther from the thoughts of the originators of the idea. They were genuinely interested in speeding production at a time when we had too little of everything. But the unnecessary haste in putting the program into effect resulted in the use of ill-considered language which gave many manufacturers a false impression of the objectives and retarded rather than accelerated the program.

A high government official recently blurted out publicly his opinion that clothes may have to be rationed. That statement started a buying rush. Soon the same official found himself in a spot where he had to make a soothing statement to stop the run.

Even more recently a blast came out of the War Production Board, via Office of War Information, indicating that in one sweep the war job of the machine tool industry in producing machine tools was at an end. Machine tool builders, who had done such a magnificent job in tooling the country for war production, must either turn to the manufacture of other war goods or close up shop.

That was a very misleading and untrue statement. Although the industry is over the war hump, it will have a big task supplying machine tools as long as the war lasts. Even now its backlog of orders is three times the total output in the best peacetime year on record.

Before being released, the statement on machine tools was not checked with WPB division heads who know intimately the machine tool situation.

The messy condition herein outlined inevitably leads to one conclusion. Mature thought should be given by proper government authorities to important proposed measures before they are ordered carried out. Too many policies are adopted without calling in for consultation the people who know the most about them.

If a policy decision is to be made about a particular industry, why not seek the advice of that industry? Moreover, it wouldn't contaminate government officials if they asked the help of trade associations. These associations are as keen about winning the war and are as patriotic as other groups with specialized interests. The labor unions, for example, are consulted often enough to please the most ardent unionist.

We heartily endorse the statement of a high Washingtonian, "The most essential thing in Washington today is to call in the heads of responsible groups, or the groups themselves, and ask their considered opinion before new policies are put into effect. That is one way in which many mistakes can be avoided and in which the war effort can be furthered."

Burnham Finney

GAGING BUSINESS

Machine tool orders to decline, while backlog provides business for several months. Wartime tool production to continue double peacetime rate. Manpower shortages loom. Aircraft production is receiving even more marked emphasis

Still a Long Way to Go The machine tool industry is far from finished with its war tooling job. It is true that most of the tooling programs for armament plants have been completed and that machine tool builders are over the hump, but backlogs still amount to about $650,000,000. This is equivalent to more than five months' production at the top rate of about $120,000,000 a month which has prevailed recently. Approximately one-third of current orders are for export to our Allies with the greatest proportion for Russia.

Recent reports emanating from Washington that machine tool production would be suddenly and sharply chopped off are misleading. Present and future orders will go through a careful screening and the volume is expected to fall off as the year progresses. This will mean a steady shrinkage in backlogs and may bring the industry's output of machine tools by the fourth quarter down to half that of the first quarter. However, the total dollar volume of production in machine tool plants should stay at a high level, because machine tool builders now are taking on a considerable amount of war work aside from the manufacture of machine tools. Knowing the skill of the industry, Washington officials wish to utilize its full capacity throughout the war. Many builders, in fact, already are turning out other war goods, some of them as many as six or seven different items.

See Double Prewar Output Though demands for machine tools will lessen considerably, production is expected to continue as long as the war lasts at a level roughly twice that of the best peacetime year. The constantly changing war requirements necessitated by shifts in emphasis on one war item as against another, and by improved design of war equipment, will provide a continuing demand for machine tools. In addition, the pressure to use machines to replace manpower will help maintain the volume of machine tool orders.

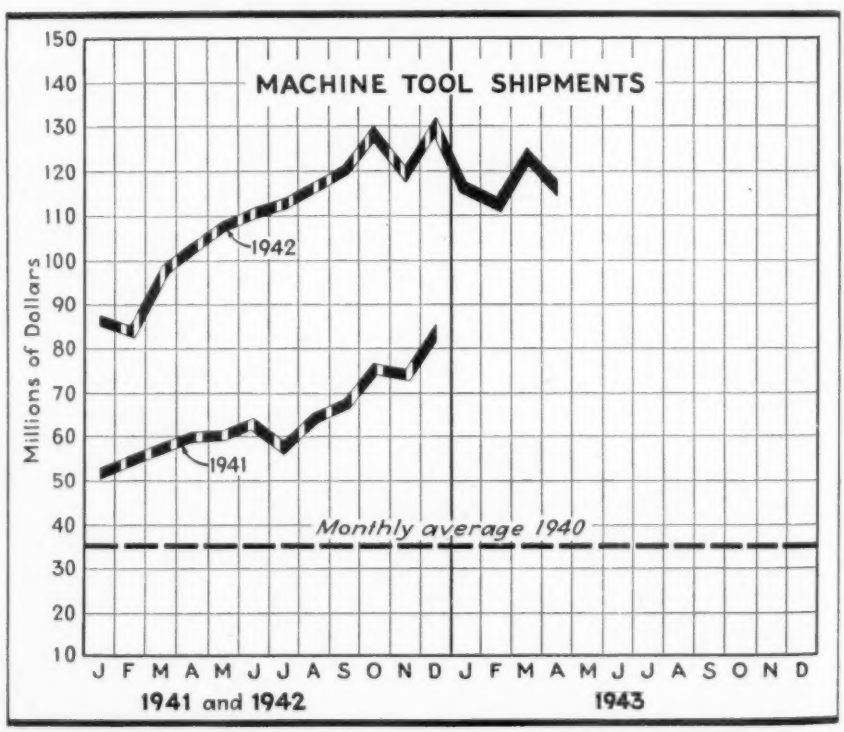
War production is expected to reach a peak in October and will stay at or near the peak volume for a number of months after that. The war production job is now one of securing quality as well as quantity. A constant shift is being made to keep the right quantities of war goods in the field. Many ordnance items which were cut back severely in recent months are not expected to regain their former volume in the immediate future. Many plants, in fact, have been completely shifted over to other products.

Industry Sets New Records American industry is constantly bettering its rate of war production, intensifying the shortages of manpower and materials. Total capacity of the plants making numerous products simply exceeds the supply of materials available. In spite of cutbacks in many lines by the armed services, an overall manpower shortage also looms. Local surpluses of labor are held to be limited and passing, both by war management and by responsible labor heads.

The Pressure Is Still On Aircraft manufacturers are still being pushed to the limit—far beyond any total tonnages heretofore thought practical. This indicates the grand war strategy. But it also presents many new and vexing problems, both for WPB and the aircraft industry. Airplane management had a two-day showdown with WPB heads recently on problems held to be handicapping the efforts of this industry to meet the vastly increased output expected of it. The industry wanted to shift certain material controls from WPB to the armed services, but WPB stood pat and will continue to direct the distribution of both raw materials and components. Meantime, WPB is putting plenty of heat on some types of war material production and on manufacturers of certain components.

Conversion Is in Again The problem of reconversion from one war product to another is being given close attention in Washington. A plant which in peacetime made automobile wheels is an example. It originally was converted to the manufacture of shell and now that its shell capacity no longer is needed, it is being retooled for the production of turbines. Some improvement is noted in the supply of component parts which recently was a critical issue.

The application of the forty-eight hour week in certain critical production centers has not worked out as well as expected.



Over the Hump—As machine tool builders shift to other products, a decrease in total output is evident, and a further decline is expected

WPB Plans More Complete Utilization of Machine Tools

Claimant agencies must submit orders to WPB for approval. Plan to attain better usage of existing facilities, while curtailing expansion, through use of centralized inventories

BY ROBERT COLBORN

WASHINGTON, D. C.—Machine tools are over the hump along with tanks, ammunition, bombs, automotive equipment, anti-aircraft and some other types of guns.

Until further detail can be worked out, two general principles are promulgated: (1) all previously approved projects for construction of new plants and machinery will be re-examined to determine whether they can be eliminated by greater use of present structures, plant facilities, machine tools and equipment; (2) no purchase of new machine tools, machinery or equipment, or erection of buildings, will be authorized until claimants prove that the work cannot be done by existing facilities.

Spokesmen for the Tools Division told the writer that some specific questions cannot yet be answered. For example, they do not know just when orders will be issued in detail; they do not know when the program will be brought into full effect; they do not know just how the tools scheduling order E-1-b will integrate with the new system.

Actual working of this tight control, affecting machine tools, probably will take the form of definite pools centered in large cities. Many small and single-purpose tools will not be affected.

Surplus Tools to Be Stored

Bookkeeping has been running far behind the movement of the tools themselves. Following cutbacks already made the Tools Division has not been able to locate the tools that were available on paper. Therefore, tools will be placed in warehouses. Nelson says the war has moved out of the broad program stage into the stage of difficult, rapidly-changing detail. Army and Navy and WPB want to have an up-to-the-minute catalog of tools, both new and used, from now on—in "stock" ready for delivery on short notice. This cannot be done with card indexes or pins.

Tools thus stored will lose machine hours, of course, but the loss, the Division figures, will be more than compensated by putting working hours on the right jobs. And the turnover is expected to be rapid.

There is no official statement how far tools will be cut back but highest authority said the other day, that production to conclude the war will need to be about double the pre-war rate.

This cutback means that many companies will have to go looking for work. Nearly a year ago WPB ordered machine tool builders not to take other kinds of contracts fearing they would go into munitions, neglect their backlogs. The order still stands. The result is that tool producers have not changed to other products except when requested or permitted by the board to do so. Now producers are asked to estimate their excess capacity after which WPB will release such part as it sees fit. Companies involved will be told to seek subcontracts or ask the assistance of the Smaller War Plants Corporation.

But machine tool producers still have to take care of substantial backlogs and replacement needs will be continuous. Though the Army, Navy and Maritime Commission may trim any given company back to 30 percent or so on deliveries to their contractors, Lend-Lease may not be affected and much of the company's subcontracting may not be affected.

Committee Set Up

To make the new machine tool and plant programs effective, a new Facilities Review Committee has been set up in WPB, on which all claimant agencies will be represented. This committee, framed to act swiftly to meet desperate thrusts of the enemy, will replace the Facility Clearance Board established last October.

All orders for new tools and equipment, including those now approved only by the Munitions Board, must after June 1 be submitted to WPB for approval, excepting "command" projects at the fronts. Each procuring service must prepare by June 1 a list of the tool orders of its contractors, classified by programs, indicating whether expansion of capacity is or is not required for each program. Where expansion is not required tool orders will be canceled. All proposals for new or available tools will be checked against "centralized" (warehouse) inventories. To keep these catalogs current, all agencies will file with WPB by July 1 a record of available manufacturing capacity not needed for their program requirements.

This control and cutback on machine tools is merely the culmination of a trend that has increased in the industry for months. "Smart producers," as WPB spokesmen put it, have already sought and obtained conversion, some of them to such extent that this new action will not upset them.

NAVY NEARLY QUADRUPLED

Navy has grown from 907 vessels of all kinds in 1941 to 3183 this year, and by July 1, 1943, will have 5100 ships. Contracts for 27,642 naval airplanes are planned for 1944 but the fluidity of aviation may bring changes in that program. Rather surprising is the small number of 100 four-engined transports for Navy Air Transport Service. Surprise, too, is the inclusion of 20 Martin "Mars" 70-ton boats, considerably changed, of course. Navy strongly criticised performance of the Mars, and the time it took in building.

Navy personnel will reach the 2½ million mark by mid-1944.

Bomber Protection—To combat attack from the air, some British ships now carry RAF fighter planes, such as the Hurricane fighter shown here, mounted on a catapault on the deck of a freighter. Having been launched and completed his mission, the aviator must either fly his plane to land, or sacrifice it in a water landing and risk being picked up at sea

International

Gear Manufacturers Devote Meeting to the War Effort

RYE, N. Y.—Clarification of new government regulations and advancement of engineering standard practices featured the 27th annual meeting of the American Gear Manufacturers Association held May 17-19 at the Westchester County Club. In addition, members and guests had the privilege of hearing a number of outstanding technical papers pertinent to the gear industry.

Sessions were opened with an address of welcome by retiring President John H. Flagg, the Watson-Flagg Machine Co. The meeting devoted to "Gears and the National War Effort" heard R. C. Sollenberger, Materials Handling Equipment Branch, War Production Board, who explained the purpose of the new Gear Division of WPB. Regional representatives of WPB were on hand to aid in answering the questions raised by manufacturers during the forum which followed.

John H. Flagg

Needs of the Navy as regards gears for ship propulsion were outlined by Capt. B. P. Ward, Bureau of Ships, U. S. Navy. Capt. Ward traced the history of the Navy's experience with speed reducers and described some of the problems now receiving attention. The use of gears in Army aircraft was detailed by Major John D. Tebbin, Army Air Force.

F. W. Curtis

Tell Berna

Frank W. Curtis, chief engineer, Van Norman Machine Tool Co., told of the application of induction hardening to gears. He stressed the excellent results obtainable through the use of the process with plain carbon steels, thus saving valuable steel alloying elements.

Tell Berna, General Manager, National Machine Tool Builders Association, in a talk on the "Machine Tool Industry at War" related the fine contribution made by machine tool manufacturers in equipping the nation's factories for war production.

Almen Speaks on Fatigue Strength

"Improving the Fatigue Strength of Machine Parts" was the subject of a paper delivered by J. O. Almen, Research Laboratories Division, General Motors Corporation. Mr. Almen described the benefits of metallurgical processes, such as nitriding and case hardening, and in addition told of the less known effects of mechanical cold working, such as rolling and shot blasting.

How a share-the-ride plan was put on a well organized basis was described by Granger Davenport, assistant chief engineer, Gould & Eberhardt Co. The association's statistical activities were summarized in an address by George H. McBride, Application Manager, Westinghouse Electric & Mfg. Co.

W. P. Schmitter, chief engineer, the Falk Corporation, offered a uniform method of preparing and editing A.G.M.A. literature which will simplify the compilation of standard practices and specifications.

At the annual dinner Aubrey A. Ross was presented with the Edward P. Connell Award which was established by the Falk Corp. as a memorial to the late Edward P. Connell. The award is made by the association in recognition of the individual's contribution to the gear industry, the gearing arts or the association. Mr. Ross recently retired from the General Electric Co. after completing 48 years of service. The presentation was made by E. W. Miller, chief engineer, the Fellows Gear Shaper Co.

Aubrey A. Ross

The annual dinner of the association was addressed by Dr. Ruth Alexander, economist. Her topic was "The Post War America That America Does Not Want."

Three industrial moving pictures were shown at an evening session: "Chips"—Warner & Swasey Co., "Aluminum Mine to Metal"; and "Aluminum Fabricating Processes."

The excellent program for the three-day meeting was due to the efforts of J. S. Watson, Link-Belt Co. chairman of the Program Committee.

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WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ALUMINUM—Producers and distributors of this product will use new form, CMP-24, to report monthly shipments, due on June 10 to cover shipments for the month of May and unfilled orders as of May 31.

CONVEYOR EQUIPMENT—Purchase orders for conveying machinery and mechanical power transmission equipment are restricted to those rated AA-5 or higher. (Amendment to Limitation Order L-193.)

HAND TRUCKS—Use is permitted of ball bearings of other than alloy steel in swivel bearings or casters used in trucks and related material handling equipment, as well as use of rerolled rail steel and Bessemer grades. (Amendment to Limitation Order L-111.)

POWER TOOLS—Provisions controlling production and distribution of certain light power driven tools have been modified slightly. (Amendment to Limitation Order L-237.)

SAFETY EQUIPMENT—Restrictions on the use of certain critical materials in manufacture have been eased. (Amendment to Limitation Order L-114.)

TUNGSTEN STEEL—Purchase and production of a greater amount has been authorized in order to save on use of molybdenum. (Amendment to Order M-21-h.)

INSIDE DETROIT

BY SILER FREEMAN

Rouge steps up engine output, partially through shifting some subassemblies to other plants. Auto makers argue over what they'll do with warplane producing experience. Alcoa engineer says postwar autos will adapt little from planes

Rouge Engine Production Up Demands for airplane engines are being met with heavy production of Pratt & Whitney motors at the Ford Rouge plant. While censorship will not permit actual figures being given out, the Air Corps has been well satisfied with the output there.

And so good have the two assembly lines been going that a third is about to go into operation there. It is now about half completed and should be finished by the end of the month.

The quality of workmanship has also brought applause from the Army.

Segregation Helps Output Production at the Rouge plant has been helped considerably by moving some of the subassemblies to other branches, such as Highland Park. Machinery has been moved from Rouge to Highland Park and Lincoln without as much as interrupting one day's output. When the $34,000,000 additional order for the P & W's was announced, the decentralization began immediately and has been carried out without a hitch. The same decentralization has been carried out at Willow Run. Many of the sub-assembly manufacturing processes have been sent to other companies but the report that most of the manufacturing processes have been moved out have met with denials by company spokesmen. A recent visit to the bomber plant confirmed their statement that only a few sub-assemblies have been moved.

Labor Shortage Dictated Step This decentralization dates back to many months ago when an agreement was worked out in Washington to sub-contract much of the work at Willow Run to solve the manpower shortage there. Ford officials agreed to this as the only way out to dwindling forces which could never meet the 80,000 and 100,000 work force first planned.

Employment at the bomber plant is now reported pretty well stabilized. It has hovered around the 40,000 mark for some time and has been going up but slowly.

Argue Over Peace Plane Post-war planning has embroiled some of the automotive companies in internecine squabbles. Talk of Detroit grabbing off the aviation spotlight come peace has met with opposition, especially in the "Big Three". In each corporation, there are two factions, one favoring entering the airplane building business and the other holding to automobiles only.

K. T. Keller is said to be having battles with members of his board. Keller is an auto man through and through and was recently accused by Wiliam B. Stout, famed inventor and one of the city leaders who has been advocating Detroit's place in the aviation sun, of tossing a money wrench into the works when a new city airport was being discussed.

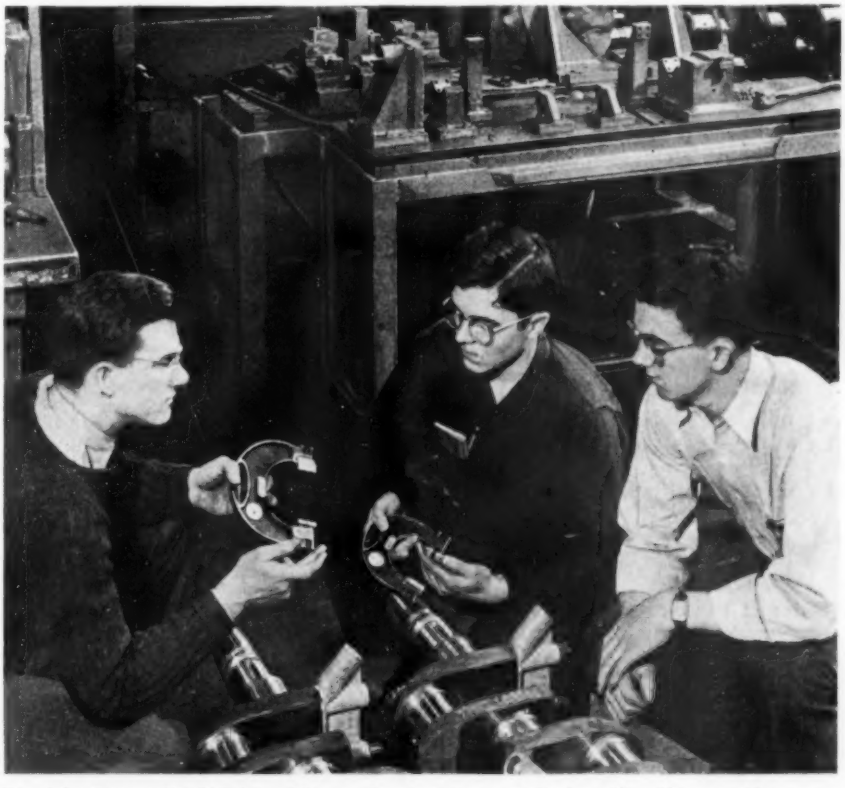
Some Would Make Planes William B. Fisher of General Motors is another who is opposed to entering an unfamiliar field. But Harley Earle and Don Berlin have their desks littered with sketches and drawings of peacetime planes. The Ford Company has a division in its top ranks on the same question.

On the other hand, the automotive firms have been perturbed by authentic reports that plane manufacturers on the coast have assigned their best engineers and draftsmen to the task of dreaming up light, economical and new-styled cars.

Layoffs Cause Worker Shifts Heavy layoffs, forecast by drastic cutbacks in the heavy armaments, have failed to materialize here so far. There are some instances, however, that some have started and more are to come.

At Pontiac, several hundred workers have been cut loose because of reduced demands for the Bofors anti-aircraft gun. The Oerlikon department is still untouched but has never been called upon for full capacity.

At Ford Rouge, while the Pratt & Whitney section is holding to a heavy schedule, the sections manufacturing tank parts have been hit hard. There have been no layoffs, however, the aviation orders taking up the slack. The same is true at Lincoln, which also has been working on tank engines and



Double-Barrelled Education—Apprentices at Caterpillar Tractor Co. may secure high school as well as Company diplomas of graduation upon completion of four-year machinist, patternmaker or foundryman courses. Above, an instructor familiarizes two apprentices with the use of snap gages

Tool Manipulator—The grinding of top faces of carbide tools is simplified and speeded by a new process developed by Carboloy and Edison General Electric. Tools may be ground at the rate of 80 to 100 an hour. The machine eliminates the human element, properly manipulates the tool and applies correct pressure against the wheel

parts. The aircraft section there just added 2,000 to keep up with orders.

Peace Mirage Is Tantalizing Favorable war news continues to make the auto makers dream that the day is near when they can get busy turning out designs and dies for new models. Many turned out to hear Frank Jardine, chief engineer of the castings division of the Aluminum Company of America toss out a few feelers on wider use of aluminum in the post-war car before the Detroit section of the Society of Automotive Engineers.

Jardine poo-pooed the "visionary" cars which have been publicized so far but said the designers all agree the post-war car must be lighter, more efficient and economical to operate. As for airplane design for autos:

Plane Offers Little to Auto "There is very little in airplanes which can be adapted to automobiles, other than streamlining and skin-loading for bodies. Autos have been streamlined as much as practical in the past and no doubt will be streamlined more in the future.

"But if an automobile is built to look like an airplane, the reaction of the public will have to be considered. The public has never accepted a very radical change in appearance.

"The skin-loaded or frameless body is not new to the automobile trade. The radial engine used in aircraft will have to be reworked to obtain a more quiet and flexible unit."

Jardine predicted that any post-war car successfully produced will be the result of a great deal of design work and extensive testing. New models must live up to present standards.

New Metals A Factor Aluminum and magnesium will be plentiful after the war, Jardine stated, and would compete with other materials on an ecomonic basis, as well as performance basis. As for weight saving, it would have to be about 500 pounds per car to make it worth while.

By the end of 1943, he revealed, aluminum ingot production would reach about 2,100,000,000 pounds as compared with 327,000,000 pounds in 1939 or 6½ times the amount produced for pre-war use. The increase in production has brought a 25 per cent reduction in price.

Jardine said that the secondary alloys, which are increasing in quantity and quality, would be available for cylinder heads, crankcases and cylinder blocks, transmission cases and many other castings.

"The price of this material after the war should be low enough to make it practical economically to use it in large quantities," he said.

Needn't Cut Size of Cars Jardine stated that a real saving in weight can be accomplished without changing the size of the present car, the road performance or appearance with "an appreciable reduction in over-all costs so that the new car will fit the post-war income." This can be brought about by more economical use of standard material, the use of materials and manufacture developed during the war and the use of lightweight materials such as plastics, aluminum and magnesium.

"It should be possible to reduce the weight of the standard 1942 car by 30 percent," said Jardine, "by completely redesigning the car to have an overall weight of 30 percent less than previous cars. Half of this weight reduction could be obtained by using aluminum on the basis that one pound of aluminum wil mean a pound of car weight saved. The remaining 50 percent should be accomplished by more economical design of the ferrous metal parts; the major parts could be made smaller and lighter for the lighter car."

WPB Approves Incentive Plan Favors Wider Use by Industry

WASHINGTON—The War Labor Board last month granted its first approval to an incentive pay scheme since issuance of the President's hold-the-line order. The plan was put into effect at Alcoa's Lafayette, Ind., extrusion plant at WPB's request, it is understood.

In addition to the Alcoa shop, several other extrusion plants have been asked by executive vice-chairman Charles Wilson of WPB to experiment with incentive pay plans. These extruding plants are naturals for the experiment. The aircraft program is imposing a demand for extrusions greater than the plants can meet. Moreover, extrusion capacity rather than supply of metal is the limiting factor; plenty of aluminum ingot is available to keep plants busy.

Thinking at WPB goes far beyond installation of incentive plans at a few bottleneck plants. The men around Wilson believe that there are large areas of war production where material is plentiful enough so that extra effort by workers in the plant can produce extra output.

Based on Man-Hour Output

The type of incentive plan favored at WPB would be based on total output of the plant. To allow for variations in payroll, the figure used would be plant output per man-hour worked in the plant.

WPB has not as yet thought its way through all the practical problems and isn't yet sure what approach it should take. Thus it can be that government sponsorship might be confined to propaganda in favor of incentive pay. On the other hand, WPB might have to take an active hand in formulating and setting up some more or less standard plan.

Loophole Was Left

Washington views affect any incentive plan, too, because of the necessity of War Labor Board approval. Flat rejection of this type of plan was prevented some time ago, however, when Wilson succeeded in selling his plan at the White House. The result was a little-noticed clause in the hold-the-line order authorizing WLB to approve incentive plans even though they would increase workers' pay. It was under this clause that WLB approved the Lafayette arrangement.

The big obstacle in Wilson's way now—and this is a major reason for delay in bringing an incentive scheme forward publicly—is the standoffish attitude of both industry and labor. It's symptomatic that the plan which Alcoa installed at Lafayette is not the Wilson plan. It's a more or less standard individual incentive plan involving establishment of individual norms for each job and payment of extra money to workers exceeding it.

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

Would handle critical components on a scheduling system, requiring claimant agencies to submit purchasing plans, establishing a system of machine-time priorities. Congress favors task force and plane over the fleet

CSP Enters Limited Field

WPB is trying to apply to distribution of critical components the same claimant agency-prime contractor-subcontractor flow system that CMP applies to the distribution of basic materials. It plans to do this through a new Components Scheduling Plan (CSP) due to go into effect June 1. CSP is to be used only in connection with 23 listed components entering into ships, power generating plants, and plants for production of rubber, high-octane gasoline, aluminum, magnesium, and steel.

These components are already being scheduled individually by WPB. Some have been scheduled for a long time, some only since last January's scheduling order M-293. The difficulty in scheduling them is the maintenance of the proper relationship between different components in the same program and the relationship of critical components, which are themselves parts of other components, to the critical components of which they are part.

Agencies Will Submit Plans

Under the Components Scheduling Plan, claimant agencies—Army, Rubber Director, etc.—will submit to WPB a schedule, projected as far as possible into the future, of the critical components they intend to buy from each manufacturer. WPB will then try to reconcile this with the manufacturer's present schedule, diverting the business to another producer if necessary. Finally, the approved schedule will be returned to the claimant agency, which will turn it over to the manufacturer as his authorization to accept the order.

In buying subcomponents, the component producer will submit a similar delivery schedule to his suppliers, with delivery dates based on the schedule submitted to him. And so on down the line whenever any one of the 23 components is purchased.

Priorities for Machine Time

By the time CSP starts, WPB will have a new device to help it along in the "machine-time priorities" which are now being worked out. This will be a form of priority entitling the firm to which it is issued to preempt the use of machines belong to other firms. Thus it will put teeth in WPB efforts to distribute the manufacture of critical components in the most efficient way possible.

Actually, this is a return to the original concept of priorities back in the days when no one dreamed of material shortages and the problem was to give munitions contracts first call on plant facilities. Since then, priorities have evolved into material-distributing devices, so that now, when manufacturing facilities are short in certain limited areas, it's necessary to create a new kind of priority.

Task Forces Replace Fleet

Reporting the largest naval appropriation in history, House Appropriations committee reveals that the fleet, as an operations unit, is out of the picture and is replaced by the task force built around airplane carriers. The modern cruiser is the ideal ship for running interference for the lightly armored carrier. Naval battles, as such, and fights between battleships, are out for good.

Strategy of sea warfare, completely changed since Pearl Harbor, now centers around air power, for which the carrier merely serves as a vehicle. Eventually, long-range planes will curtail, or possibly eliminate the carrier. Glenn Martin, and other competent men, have said that this process may take only ten or fifteen years.

Grim struggle between the battleship admirals and the new school of air power still goes on, with the modernists gaining step by step, supported by the public and by congress. The high command still feels the need of battleships to the extent that six of the new 35,000-tonners are now in service, and two more are nearly ready.

Anti-Submarine Emphasis

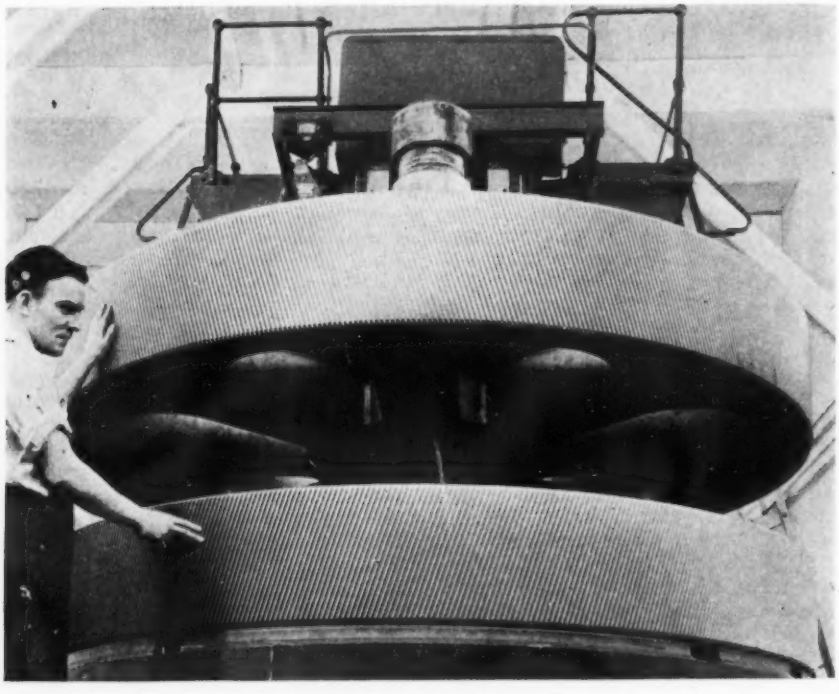
The amount just appropriated by the House Committee is over 29 billion dollars. One of the main items to be procured is escort vessels for killing submarines. Some of the escort vessels are small carriers, using airplanes for eyes. Despite all the glamour and power of modern aviation, the submarine is still the most destructive of all weapons; there is no sure-fire counter weapon in sight.

Needed also for final phases of the war are landing boats—invasion barges. The House has just passed a bill authorizing addition to the overall naval program of 1,000,000 tons of such craft, including also tugs, rescue craft, rearming launches, etc.

International

Lightly, Lightly, What Hangs Over?—A new Army Sikorsky Helicopter takes off in front of the Capitol, Washington, in observance of the twenty-fifth anniversary of the first air mail flight

Hendy Company Expansion Leads Pacific Industrial Development



Bull gears of a 148 in. pitch diameter for 8,000 hp. cargo vessel turbines are now being made in the Joshua Hendy Iron Works, Sunnyvale, Calif.—a prewar modest producer of mining machinery, dating from gold rush days

SUNNYVALE, CALIF.—First on the Pacific Coast and one of the few such plants in the United States is the marine turbine department of the Joshua Hendy Iron Works, here, now in full scale production. The Hendy company, dating from the Gold Rush days of early California, was stepped up from peace time production of mining machinery on a relatively limited scale to being the largest producer of marine engines in the world in a little more than a year and a half. Prime mover in this task has been the firm president, Charles E. Moore.

The expansion may be realized when one considers the use of Hendy-produced engines: more than one-third of all Liberty ships are powered with Hendy-built 2500 hp. triple-expansion steam engines. Delivery has been started of a new 2750 hp. engine for a class of vessel still shrouded in secrecy. Two types of turbine-powered vessels are also to be powered with Hendy equipment: a 4000 hp. turbine for the C-1 class and a 8000 hp. for the C-3 class.

Hendy is relying on installations of the most modern gear-cutting equipment. An example is the 184 in. Muir which cuts the bull gears for turbine reduction gear units. Large Gould and Eberhardt hobbers, installed in air conditioned rooms operate continuously seven days a week.

Women Cause Changes

PROVIDENCE, R. I.—Faced with an increasing shortage of men, Brown & Sharpe Manufacturing Co., here, has hired 1350 women and expect to have 2500 on its payroll by January.

The addition of these workers has involved a plant-wide program of changes, including the installation of ten sunlit rest rooms with facilities for making tea, coffee or soup and the employment of 19 counselor matrons to advise and "mother" the women employes and to supervise recreation.

Every new woman worker is provided by the company with two uniforms and hats and is given a special fitting for shoes with low heels and protective plastic toes.

There's hardly a job in the entire shop a woman isn't doing, or couldn't do, says John T. Hall, in charge of employment matters. The girls are doing machine operations, assembly work, painting machinery and all operations of producing vernier calipers.

Two of the rest rooms have been equipped for the showing of movies, and every three weeks the girls from all over the plant are invited to a show. Usually OWI films are used. Two other restrooms are supplied with pianos and music. Every Thursday afternoon, during lunch hour, community singing is held.

Shift to Offensive Armor Brings Layoffs in Canada

OTTAWA—Production of a dozen or more important items of war equipment is being or is about to be halted or curtailed in Canadian plants with contracts about 40 percent to 60 percent completed. Most of the items are in ordnance. The curtailment, dictated by over-production in some cases and in others by changes in designs due partly to the shift of emphasis from defensive to offensive equipment, will entail substantial layoffs of workers.

Items which are expected to be affected by the production stoppage or curtailment include: the successful 25-pounder artillery gun being produced by Sorel Industries Limited at Sorel, Quebec; 40 mm. Bofors anti-aircraft gun made by Otis-Fensom at Hamilton, with half the current order completed; 6-pounder anti-tank gun made by Dominion Engineering Company, Montreal and carriages for this weapon made by General Motors in the West, with something like 60 percent of the order completed; 4.7 anti-aircraft gun, being produced by Westinghouse Company at Hamilton and Canadian General Electric Company at Peterboro; Bren machine gun being made by John Inglis Company of Toronto, with half the current order delivered; Boyes anti-tank rifle being produced by Inglis, with order about 60 percent completed; Sten machine gun, by Small Arms Limited, Toronto, with about half the current order finished; ammunition for some of these weapons being made by several firms.

In consequence of these and other factors the manpower situation in Canadian war industries is rather badly scrambled. Although the heavy layoffs are in sight Munitions and Supply Minister C. D. Howe states that there is a current and prospective shortage of manpower for war plants. Instead of about 1,250,000 workers who have been used in these plants, which number is said to be required despite the coming curtailments, it is now estimated that only about 1,000,000 will be available during the summer and fall.

The army is planning to go into war plants and comb out 25 percent of male workers within the draft age brackets.

Consider Postwar Surplus

Canadian manufacturers noted with some misgiving the report from Washington of the New Deal suggestion that the U. S. government take over after the war control and operation of government-financed war plants as one means of providing employment, the plants to convert to civilian production of supplies for export to countries freed from Hitler rule and for sale to low-income domestic consumers. Canadian industrialists have but argued that government-controlled plants should not be turned over to competitive civilian production without consultation with established manufacturers.

SPOTTING THE AIR NEWS

Peak plane production is foreseen, followed by leveling off. Heavy planes are being emphasized. Superior performance increased, beyond predictions, total of our planes in action. Scheduling bombs for all planes brought overproduction

The President told his press conference the other day that he believes the United States is now producing more airplanes than the rest of the world combined. Our production rate now is about 7,000 per month and the official plan is to run that figure up to 10,000 by November or December, at which point the program will be leveled off. Which means that, during 1944, if the war continues and if we need them, we will build 120,000 units. The plane program will be leveled off at 10,000 for two reasons: we probably shall not need more than that, and our basic materials plant will not support any more. To increase the schedule above that point, we would need additional facilities to make aluminum, electric furnace steels, and other materials and components.

It would cost about one billion dollars, according to an unpublished official statement, to construct facilities for materials to run the output up to 12,000. If you complain that the airplane program is different every time you read about it, the answer is that the fluidity of war makes the changes necessary. Plans will continue to change from month to month, or even oftener. Preparations for the leveling process will begin as early as October. You have already read about cut-backs on orders for tanks, bombs, ammunition, anti-aircraft guns. The day will come, possibly long before the war ends, when the airplane schedule will be cut back and our materials and energies will be switched to production for the final squeeze on the Japs, or for the beginning of peace.

It is no longer accurate, the President says, to talk about planes in terms of units. This has been said many times before, but this time, the Chief Executive follows through with poundage figures. In 1941, he says, total output of airplanes was 87,000,000 pounds; in 1942 it was 291,000,000 pounds; in 1943 it will be about 911,000,000 pounds; and he estimates the 1944 figure at 1,417,000,000 pounds. The shift continues to heavy bombers (four engines) which are now coming off the line at the rate of about 500 per month, and toward long-range fighters and big cargo planes. Light bombers and defensive fighters, like the superb Spitfire, are being cut back, and the dive bomber is going out of the picture, because ground fire has become so accurate that diving means suicide except on un-defended targets. Heavy bomber output is about six months ahead of schedule. At least half of this is accounted for by the Boeing setup, which includes Boeing, Vega, and Douglas. The rest is Consolidated. Whether the President had in mind the early fabulous plans of Willow Run to turn out Consolidated B-24s when he made his statement, is not clear.

Heavy bombers are so important in our plans to rip out the innards of the Nazi war machine—to weaken their ground resistance to our troops, and to hit Japan from distant spring boards, that the Aircraft Production Board setting up a new "planning and control" board, to hook in with the existing Aircraft Resources Control Office. The new authority will be informal. It has already resulted in an extended meeting of producers, Army and Navy officers, and WPB executives. It is searching for means to hurry the heavies, to facilitate the shift from other types.

Our attrition rate on aircraft was calculated, when the war began, at 20 percent per month. Instead of that, the rate turned out to be seven or eight percent, and it will not be more than 10 percent at the worst. That pleasant surprise gave us more planes at the front than we expected, gave us more superiority over the Axis in Europe and in Africa than we had hoped for. Probable reason for the under-estimate was the fearful rate at which the Germans mowed down unprepared enemies, and lack of knowledge of Japanese aviation.

Speaking of estimates, the requirement for air-borne bombs was so heavily over calculated that orders recently had to be cut back something like 75 percent. In their anxiety to be caught long rather than short, the slide rule boys provided bombs a-plenty for *all* bombers scheduled for production. They forgot perhaps, that a large percentage of bombing planes would be in modification centers, in transit, in repair shops, grounded in storms, and some of them lost, instead of bombing.

Few people realize how many airplanes are in the "pipe lines" that reach to the far fronts. Considering the damage done by air attack on Nazi airplane plants, it is probable that Germany is fighting extensively with pipeline production. It is more than probable that, when the Germans are licked, we can do the Japs in with our own pipe line planes and other equipment.

International

Business as Usual—Malta, Britain's famous Mediterranean bastion, was aided in withstanding the all-out air attacks of the Axis and still do its part in the war effort by a system of underground shelters and workshops

Cincinnati Planer Co. received the burgee before employees and guests. Pres. B. B. Quillen, R. Volk, oldest employee and V. Schoolfield, gen. mgr., (l. to r.), hold it

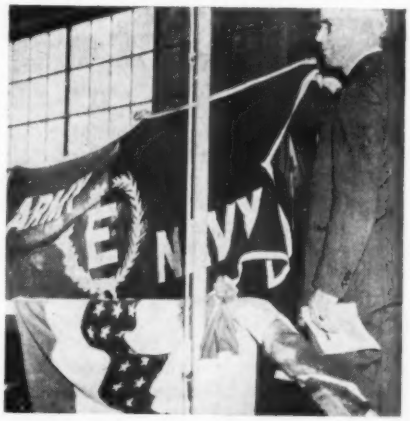
Firth-Stirling Steel Co. employees and officials, and their guests heard Lt. Col. Robert C. Downie, standing, above, laud their war effort as he awarded the "E" burgee

Merit Awards Made

WASHINGTON — Among additional plants receiving Army-Navy "E" awards for excellence in performance of war work are:

American Brass Co., American Locomotive Co. (Railway Steel Spring Div.), Ampco Metal, Inc., Aviation Corp. (Plants 1 and 2), Blaw-Knox Co. (Lewis Foundry & Machine Div. and Martins Ferry Div.), Borg-Warner Corp. (Plants 1, 2 and 3), Boyertown Auto Body Wks., Buffalo Arms Co., Crucible Steel Co. of America (Halcomb and Emerson Ave. Wks.), Defiance Machine Wks., Dow Chemical Co., General Motors Corp. (Fisher Body Div. Plant 21 and Detroit Aircraft Unit) Geometric Tool Co., Goodyear Aircraft Corp. (Arizona Div.), Ladish Drop Forge Co., Minneapolis-Moline Power Implement Co., Reliance Mfg. Co., Sullivan Machinery Co. (Michigan City), Pratt & Whitney Aircraft Div. of United Aircraft Corp. (Plants L and M), Skilsaw, Inc., Union Metal Mfg. Co., Universal Engineering Co., Wright's Automatic Machinery Co.

American Foundry Equipment Co. received the "E" award burgee being held by, (l. to r.), Pres. Otto A. Pfaff, Commander H. O. Lord and J. Rob't Bunch, union official



Geo. D. Roper Corp. received the "E" award before employees, public officials and members of the armed services. Above, President Stanley H. Hobson holds the burgee

Foote Bros. Gear and Machine Corp. employees and executives with Army and Navy officers hold the "E" flag. L. to r., Rear Adm. C. H. Woodward, J. D. Persily, F. H. Klinck, R. N. Oaf, H. E. Soderling, Pres. W. A. Barr

Desmond-Stephan Mfg. Co. officials pose with armed service officers after the award of the "E" flag. From left to right appear R. S. McConnell, Maj. Ralph H. Coburn, Capt. Hugh Reid, Lt. R. A. Hoehne and Logan Fansler

NMTA Re-Election

CHICAGO—The National Metal Trades Association, at its annual convention at the Palmer House, here, May 26 and 27, re-elected its officers for another year. Roe S. Clark, vice president and treasurer, Package Machinery Co., was re-elected association president; H. H. Kerr, president, Boston Gear Works, first vice president; and George A. Seyler, vice president, The Lunkenheimer Co., second vice president and treasurer.

Manpower Consultant Staff Aids Plant Labor Problems

WASHINGTON—The War Manpower Commission's recently organized Bureau of Manpower Utilization, now about three months old, is finding an important job for itself. Organized under the leadership of Dr. Frank Sparks, president of Wabash College, director and former head of Noblett-Sparks Industries, the BMU is to consist of some 200 "manpower consultants." Original idea was that whenever a manufacturer found himself in trouble on a manpower problem he would call in one of the consultants. Actually the cases that BMU gets involved in fall into several classes:

A major type comes in through the Employment Service. When an employer starts putting heavy demands on USES for men, the service begins to wonder whether he's making the best possible use of the men he has. It's up to BMU to find out. Thus when Henry Kaiser started hauling men in wholesale from the New York City area, USES reminded him that there were a lot of rumors going around about his use of manpower and did he mind if BMU looked over his yards. A flock of BMU men spent several days in conferring with Kaiser officials and studying his operations.

BMU, in this case, offered to find Kaiser a good man to work out a personnel set-up for him. Kaiser jumped at the chance, and Arthur H. Young, who used to be with U. S. Steel, is now studying the yards.

Investigate on Invitation

Another type of case arises from complaints. Hundreds of workers in the plants write letters to the President, their congressman, or to Paul McNutt, complaining that their employer is hoarding labor, that they don't have enough work to do, etc. Such complaints are referred to the manpower consultant in the area. If a lot of complaints come in on the same employer, the consultant will drop around to find out what's wrong.

An increasingly important type of case arises out of the analysis of manning tables. These tables—tabulations of the personnel situation in a company submitted to WMC to obtain a plantwide selective service program—come under BMU's jurisdiction. By comparing the manning tables submitted by different firms in the same line of work, a manpower consultant can get a pretty good idea which firms are using too many men. Then he can ask permission to look the situation over. (BMU men are not supposed to go into a plant except on invitation.) Although employers were slow to take to the plan, they are now beginning to use them. Last month nearly 650 tables were approved, more than in the entire preceding five months. They will soon give a good industry cross-section.

Washington Appointments

WPB, Miscellaneous:

W. John Logan, director Distribution Bureau. This Bureau also includes the Compliance Div. and Canadian Div.; Platt C. Benedict, deputy director Zinc Div.; Arthur Newhall, executive director Combined Production and Resources Board.

Industry Advisory Committees:

James W. Crofoot, Farm Machinery & Equipment Suppliers; K. W. Anderson, Garden Tractor and Equipment, and Tractor industry.

NAMES in the NEWS

Fred O. Burkholder has been named president of Ahlberg Bearing Co., Chicago, to succeed the late C. J. Bender. He joined the sales force of the company in 1915, and after serving as manager of several of the branches he became sales manager in 1926, and was elected vice president in 1928. C. W. Pearsall, formerly general sales manager, has been advanced to vice president. He has been connected with Ahlberg since 1919, serving in the Chicago and Philadelphia branches.

Ahlberg Bearing Chief Executives

F. O. Burkholder

C. W. Pearsall

Gordon Lefebvre

Gordon Lefebvre, formerly vice president and general manager of Cooper-Bessemer Corp., engine, compressor and machinery builders, Mount Vernon, Ohio, has been advanced to president and general manager. Mr. Lefebvre has been associated with the corporation for the past 19 months, and was previously in charge of the diesel engine division of American Locomotive Co. before joining the Cooper-Bessemer Corp. He was at one time connected with General Motors Corp.

J. C. Galbreath

J. Charles Galbreath has been promoted to vice president of Plomb Tool Co., Los Angeles. He has been for many years active in both the sales and manufacturing phases of the company. Recently he has been in charge of the contract department where his duties have included the direction of war production orders. Mr. Galbreath will also retain general supervision of that department.

J. B. Tytus, who has been vice president in charge of operations at American Rolling Mill Co., Middletown, Ohio, has become vice president in charge of technical development. He has been associated with the organization since 1904.

Richard W. Millar, formerly president and director of Vultee Aircraft, Inc., Downey, Calif., has become head of a new aircraft firm known as Avion, Inc., Los Angeles. Don I. Carroll and R. W. Palmer have been named vice presidents of the company.

F. J. Healy has been appointed vice president in charge of operations of Sylvania Electric Products Inc., Salem, Mass., makers of lighting fixtures and appliances. Previously Mr. Healy was vice president in charge of the lighting division, and has been connected with the company for many years. Chester F. Horne has been advanced to lighting division general manager.

E. A. Swanstrom has been appointed president and general manager of the newly formed Penn Engineering & Mfg. Corp. of Doylestown, Pa. which has been organized to manufacture self-locking nuts and aircraft fittings. Mr. Swanstrom was head of Elastic Stop Nut Corp. of America, Union, N. J., from 1940 to 1942. B. C. Sandemar, formerly chief engineer of that company, has been named vice president and chief engineer of the new outfit.

S. Leroy Crawshaw has joined the Lynwood plant of Western Gear Works in California as plant manager. He entered the employ of Westinghouse Electric & Mfg. Co., Pittsburgh, in 1919 as a draftsman and held positions as sales engineer, sales representative in the Dallas office, application engineer, then chief engineer and manager of engineering at the Nuttall Works.

Thomas F. Hanley has been made general manager of Dowty Equipment Corp., Long Island City, producers of hydraulic aircraft equipment. He will continue as treasurer and director of the firm.

Judson C. Travis, formerly assistant to the president of Handy & Harman, New York City, was elected vice president in charge of sales a recent meeting of the directors.

J. M. McLeod, formerly assistant sales manager at the Elmira, N. Y., plant of Hardinge Brothers, machine tool manufacturers, has been named district manager of the Hartford office of Hardinge.

L. A. Shea has been named district manager for the Chicago territory of Henry L. Crowley & Co., manufacturers of powdered metal parts and bearings, and will make his headquarters at 163 Linden Ave., Oak Park, Ill. He was previously associated with the Moraine Products Div. of General Motors Corp. and more recently handled sales promotion for Burgess-Norton Co., Geneva, Ill., automotive parts and metal stampings producers.

William A. Cooke, in charge of industrial relations at the Burbank plants of Aircraft Accessories Corp., has been named vice president of the Burbank division.

E. Robert Isbell has been appointed division manager of the Aviation Corp. in charge of its subsidiary, American Propeller Corp. and of the Liquid Cooled Engine Div., Toledo. Mr. Isbell joined the Aviation Corp. after five years in charge of production, traffic and export for Packard Motor Car Co.

W. B. Muse has been named sales manager of Industrial Abrasives, Chicago, manufacturers of coated abrasive disks. For several years Mr. Muse was sales manager of the Sterling Tool Products Co. of Chicago.

Head New Aircraft Fittings Firm

E. A. Swanstrom

B. C. Sandemar

Charles W. Pearson, formerly executive vice president of Buffalo Foundry & Machine Co., Buffalo, has become president of the company. Milo T. Silverling, a vice president, has been advanced to executive vice president and general manager.

C. P. Milne has become manager of the Massey-Harris Co., tank division at Racine, Wis., succeeding E. G. Burgess who has been transferred to the company's airplane factory at Weston, Canada.

Roy E. Smith has joined Kelly O'Leary Steel Works, Chicago, as sales manager. He was formerly associated with Armco Drainage and Metal Products, Inc., subsidiary of American Rolling Mill Co. of Middletown, Ohio, for 14 years.

Robert R. Zisette has been named general sales manager of SKF Industries, Philadelphia, manufacturers of ball and roller bearings. He was connected with the Cleveland office for seven years, and was promoted to the position of district manager of the Cincinnati Office, then last year Mr. Zisette was advanced to assistant sales manager.

BUSINESS ITEMS

Colonial Broach Co. has completed a new plant on Hoover Rd., Detroit, which more than quadruples its productive floor space over prewar facilities. The plant includes an extensive heat-treat department and provides a dust collecting and washing installation for all air circulated in the plant.

J. H. Williams & Co., manufacturers of drop forgings and drop forged tools, has announced removal of its stock products sales offices from New York City to the plant at Buffalo. A local sales office will be maintained in New York to serve the Metropolitan area.

Tool Engineering Service, handling standard and special machinery, tools, gages and industrial equipment, has been established at 505 N. Twenty-Second St., Birmingham, Ala., with Harry D. Frueauff, Jr., as president.

Cook Electric Co. has opened a new plant for the Bellows Div. at 909 Diversey Parkway, Chicago, with a modern testing laboratory for altitude tests for aircraft work. William F. Laser, formerly associated with Chicago Metal Hose Corp. and Carnegie Illinois Steel Corp., is manager of the plant.

Shafer Bearing Corp., has announced removal to 1412 W. Washington Blvd., Chicago.

Moore Drop Forging Co., Springfield, Mass., is building an addition to its plant for the manufacture of aircraft parts.

Palmer-Shile Co., Detroit, has been placed in general charge of all sales of the Briggs & Stratton Air-Saver air valves. The equipment will continue to be manufactured and marketed as a Briggs product.

Aircraft Accessories Corp. has announced the opening of plant No. 3 in the Burbank, Calif., area under the supervision of W. A. Ashton.

MEETINGS

National Metal Trades Assn. Production conference. Palmer House, Chicago, Ill. May 26-27.

American Iron and Steel Institute. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. May 27.

Society of Automotive Engineers. Diesel Engines & Fuels and Lubricants meeting. Carter Hotel, Cleveland, O. June 2-3.

American Electroplaters' Society. Annual meeting. Hotel Statler, Buffalo, N. Y. June 7-9.

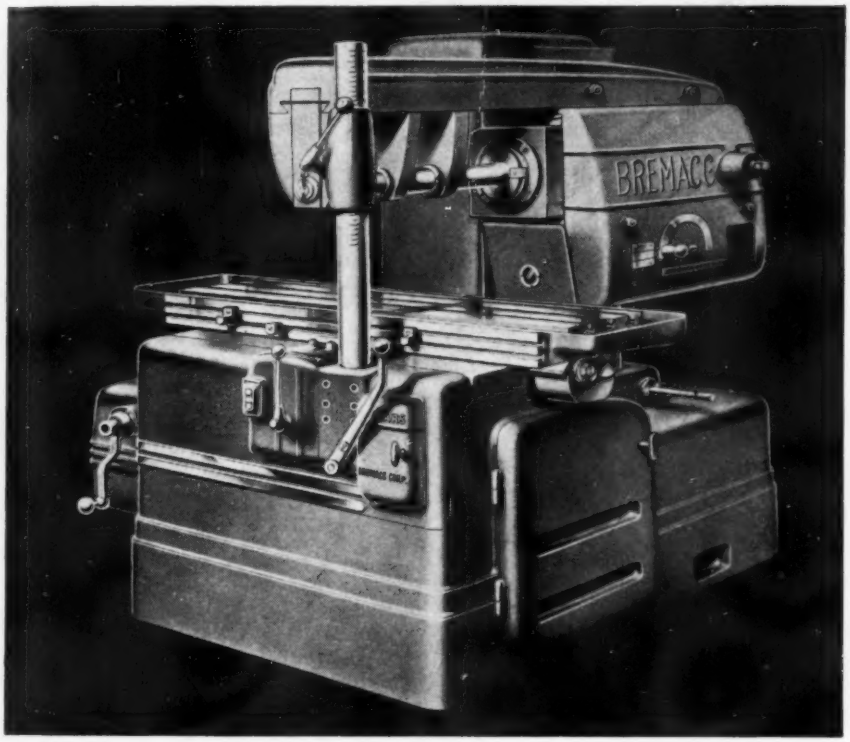
Society of Automotive Engineers. War Materiel meeting. Book-Cadillac Hotel, Detroit, Mich. June 9-10.

American Society of Mechanical Engineers. Semi-Annual meeting. Hotel Biltmore, Los Angeles, Calif. June 14-17.

American Society for Testing Materials. Annual meeting. Hotel William Penn, Pittsburgh, Pa. June 28-July 2.

SHOP EQUIPMENT NEWS

Bremacc No. 4 Down-Cut Milling Machine Handles High-Speed Production Operations



The Model No. 4 milling machine introduced by Bremacc Corp., 2030 East Grand Blvd., Detroit, Mich., is designed for down-cut milling on a precision, high-speed production basis. It is equipped with two unsplined leadscrews that are so connected in relation to each other that the effective bearing surface, with the feed nut, is constantly in tension through the use of a synchronizer sleeve, conventionally arranged outside the gear housing in the table. Axial play in the thread shoulders of the leadscrews is thus avoided.

Dovetail ways are provided for travel of the work table. The rear slide is permanently fixed, while cross adjustment of the front slide is accomplished by means of adjusting screws without removal of the table, avoiding the necessity of taper gibbing. Table measurements are 20×72 in., and it has a 48 in. maximum length of travel. The table is amply channeled and assures rapid disposal of chips. The coolant return is through a channel at the rear side of the table.

The table feeds range from ½ to 30 in. per min. through semi-quick change gears. Standard rapid traverse is 125 in. per min. Both table feeds and rapid traverse can be operated manually or automatically in either direction. Automatic reversing and jump feeds are also available, permitting the use of work fixtures on both ends of the table. The table travel is free to function as long as the main motor is in operation, regardless of whether the cutter is rotating or not. The operating lever, which controls the feed and rapid traverse cycles, is mounted directly in front of the operator in a vertical position. Large double oil type disk clutches are used on both rapid traverse and feed.

The spindle nose is a standard No. 50. A draw bar operates from the rear of the machine. Coolant and chips are shielded from entering the bearing chamber which carries a large supply of spindle lubricant. A 30 deg. helix driving pinion and gear provide smooth driving power to the cutter. The spindle of this machine is of extremely large diameter, and a special feature can be incorporated in the machine whereby the spindle can be shifted to allow for cutter drag on face milling operations. Spindle speeds range from 25 to 1,250 r.p.m.

The elevating screw housing is mounted directly below the spindle housing, and the elevating screw is carried in a bronze nut mounted in a ball bearing assembly and is worm gear driven, having a drive shaft which extends out to the right side of the machine. Directly above is a shaft for moving the spindle housing in and out. Large graduated dials are mounted on the extension shafts. The main gear box has high and low speed ranges in connection with the spindle speeds. Automatic lubrication is provided throughout the machine.

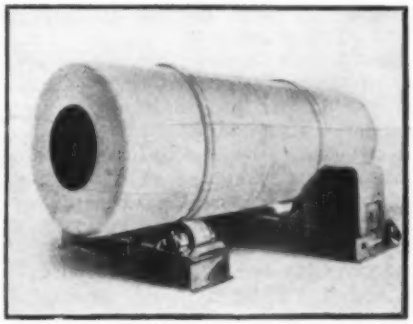
A safety lock permits the clutch lever to function only for the particular job for which it was originally set up. In connection with the main clutch lever, a control switch cuts off cutter lubricant automatically when the cutter is stopped. However, the coolant supply can be left on or controlled automatically at the switch.

Power is supplied by an individual 10 hp. motor, and an electric panel carries a 10 hp. starter as well as the coolant pump starter. Electrically operated relays for shifting the clutches are also mounted on the panel.

The maximum distance of the spindle above the table is 20 in. Maximum cross travel is 10 in. The machine measures 72×62×64 in.

Ransome Offers Turning Rolls For Cylindrical Work Welding

Turning rolls for position-welding long drums, tanks and other heavy cylindrical pieces are fabricated by Ransome Machinery Co., Industrial Div., Dunellen, N. J. The set consists of a pair of motor-driven rolls controlled through a Reeves variable-speed unit, giving a range of speeds to meet individual job requirements. A pushbutton control is furnished for forward or reverse rotation. Means are provided for changing the center-to-center distance of the rollers for handling work from 2 to 14 ft. in diameter. One or more sets of idler rolls are used, depending on the length of the cylinder being welded. Units of various capacities handle loads up to 75 tons.

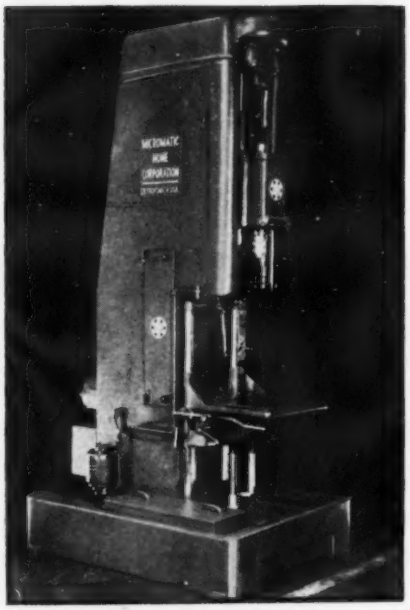


Micromatic Builds Vertical Honing Machines With Capacity to Handle Small Diameter Work

Micromatic Hone Corp., Detroit, Mich., has introduced a vertical honing machine which is available in two models. One model has a capacity from ¼ to ⅞ in. diameter work up to 12 in. long, and the other from ⅞ to 2 in. diameter work and up to 12 in. long. Both machines have a maximum working stroke of 15 in.

The spindle is driven by a spline which is belt driven. The spindle is also arranged with integral, mechanically actuated reciprocation of the tool. The entire spindle head is also reciprocated on flame hardened and precision honed bars under hydraulic control with adjustable speed. Standard manual adjustment is provided for the spindle head, and also an adjustment of lift-out stroke above the operating stroke.

Additional hydraulic controls provided in the hydraulic control panel include: an automatic timer for cycle of spindle head movement; manual visual control of tool approach to the work; dwell control for spindle head stroke, emergency stop for spindle head movement. Electric controls comprise pushbuttons for start, stop and short stroke. These machines are regularly furnished with riser block tables and have ventilated columns.



Taber Shear-Hardness Device Measures Paint-Film Strength

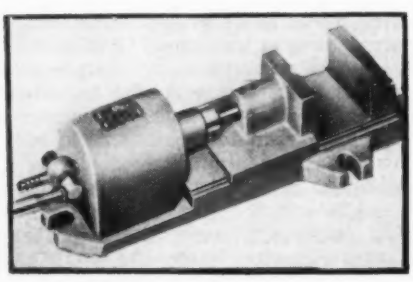
A shear-hardness attachment has been developed by Taber Instrument Corp., North Tonawanda, N. Y., for its abraser. This device measures the toughness quality of surface finishes, such as paints, and their ability to resist scrapes and abuses.

A weight slides along the calibrated beam until it is located in the position where the correct load permits the tool point to cut a groove in the surface finish without digging through to the base material. Several grooves are made in the surface and the most representative one is selected to measure to the nearest thousandth of an inch. A special micrometer is furnished to make the measurement. The shear-hardness is calculated by taking the reading from the calibrated beam at the forward edge of the adjustable weight which, together with the width of groove determines the result by a mathematical formula. A 4 in. square sample is all that is required to make the test.

Mead Model 42 Air Vise Provides Two Jaw Settings

Two jaw settings are provided on the Model 42 air vise developed by Mead Specialties Co., 15 South Market St., Chicago, Ill. The smaller setting gives an opening from 0 to 2 in. while the larger setting gives an opening from 1⅜ to 3⅜ in. The change can be made by unscrewing the shear pin which passes through the end of the ram and inserting it through the second hole. A larger opening can be obtained by moving the air cylinder farther back on the base of the vise. Dovetail ways for the sliding jaw provide smooth action. Lugs are provided at both ends of the vise, as well as at both sides.

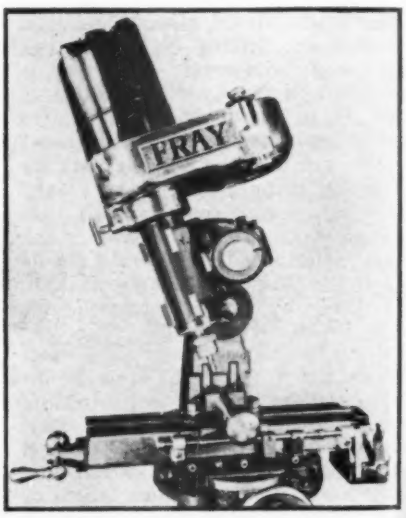
Two types of foot control valves can be furnished, an "on" foot control which releases the work when the button is pressed and holds it at all other times, or the "off" type which holds the work while the button is held down, but leaves the jaws open at all other times. Either model may be set up for automatic operation by functional parts of the machine. The speed of the stroke can be regulated either by using the hand valve or by installing this valve on the intake side of the foot control valve and attaching the hose from the foot control valve to the cylinder by means of a standard hose nipple. A power stroke of any desired slowness can be obtained without retarding the speed of the return stroke. This vise measures 14×5⅜ in., and weighs 13 lb.



Fray Milling Attachment Takes End Mills to ½ In.

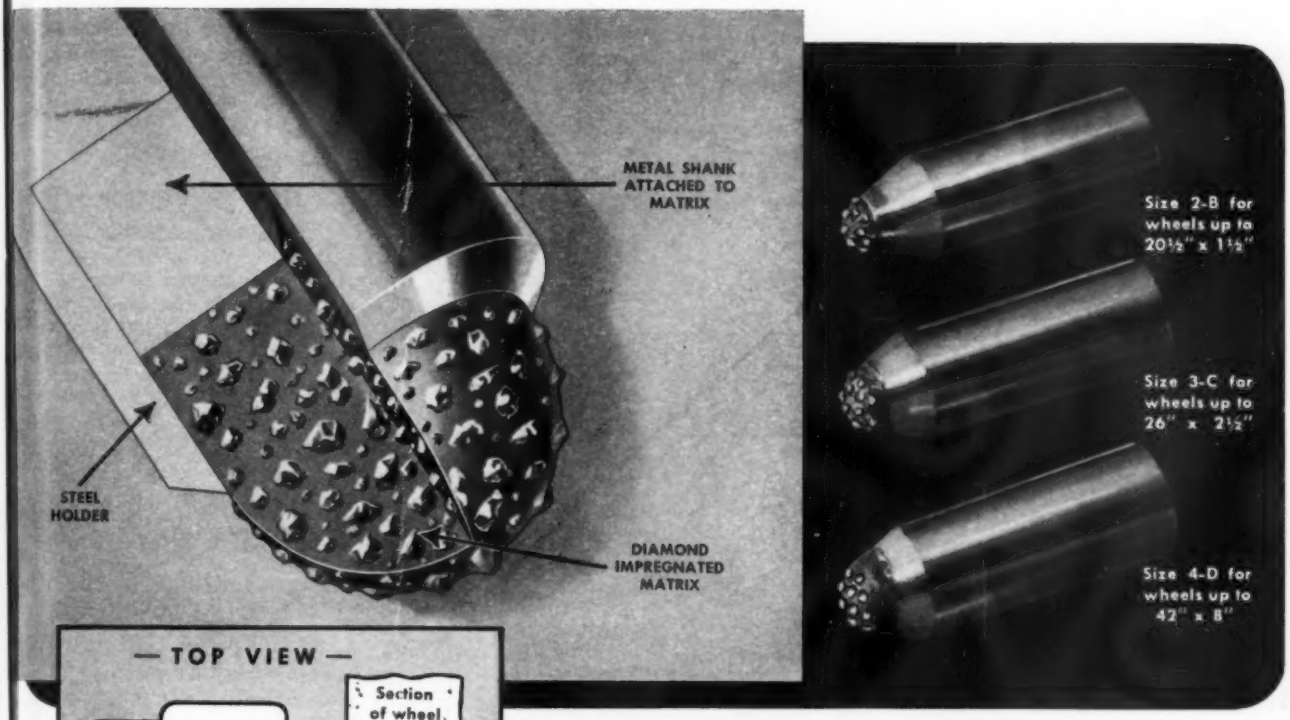
The design of the Type F vertical milling attachment made by Fray Machine Tool Co., 501 West Windsor Road, Glendale, Calif., permits quick changing of cutting tools. The unit will handle up to ½ in. end mills, and is suited for use on bench and floor model milling machines. A spanner is furnished to hold the spindle while adjusting the collets. Another feature of this attachment is the quick ejecting collet with hardened tightening nuts.

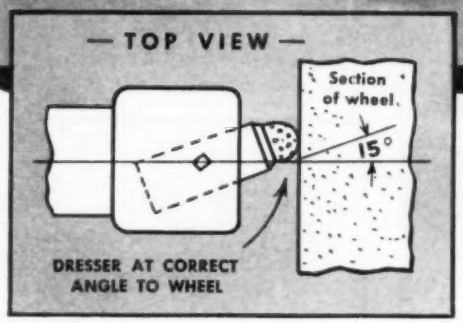
A ½-hp. motor is supplied, available in either 1,750 or 3,500 r.p.m., with four spindle speeds available. The adjusting screw for the motor bracket is placed so that the motor swings completely around the head. This milling attachment has forward, stop and reverse controls. A four-sheave idler pulley shaft is supported in the bronze yoke by thrust bearings. The yoke and belt are protected by an aluminum guard.



The spindle housing can be turned 30 deg. either side of vertical. The overarm is calibrated in 360 deg. The overarm adapters are available in various sizes to fit standard overarms.

Here is the most *"fool-proof", "abuse-proof"* way to use diamonds for dressing grinding wheels


METAL SHANK ATTACHED TO MATRIX
STEEL HOLDER
DIAMOND IMPREGNATED MATRIX
Size 2-B for wheels up to 20½" x 1½"
Size 3-C for wheels up to 26" x 2½"
Size 4-D for wheels up to 42" x 8"



Easy to Use

Simply place the dresser in a holder, on a 10° to 15° angle and put holder in your standard adaptor. Give dresser a ¼ turn in holder daily and a new cutting surface is presented to wheel. No remountings necessary!

You'll have no worries about *single, large, expensive* diamonds when you use the Diamond-Impregnated Carbide (D.I.C.) dresser. Contains a multiplicity of sharp diamond particles firmly embedded in a cemented carbide matrix moulded to shape of each diamond. They can't come loose—can't drop out! Every diamond stays on the job until the last carat of usefulness is consumed.

"D.I.C." dressers save you money and time all along the line. No remountings required—just a ¼ turn of dresser in holder presents a new cutting surface. No switching to smaller jobs as the dresser wears. You can use it throughout its life on the same job if necessary. No moving parts to repair or replace. Uniform price.

Save at least 25% annually on dresser costs. Write for folder DR-100.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

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Another USE FOR CARBIDES

CARBOLOY CEMENTED CARBIDE DIAMOND IMPREGNATED DRESSERS

For GENERAL USE ON GRINDING WHEELS

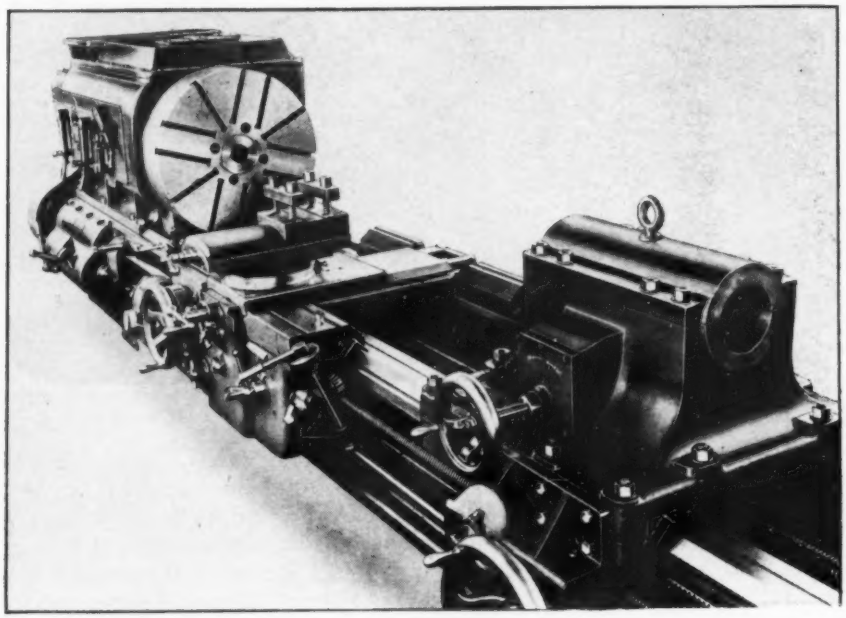
Sommerfeld Builds 50- and 60-In. Lathes in Two Types To Bore and Turn Simultaneously or Turning Only

For heavy-duty, large diameter turning and boring, Sommerfeld Machine Co., Braddock, Pa., has introduced 50- and 60-in. lathes obtainable in any bed lengths. The machine is available in two types, the Type BT for boring and turning simultaneously, and the Type T for turning only. They are suitable for rapid production of such items as medium gun tubes, hollow propeller shafting, as well as solid products of any length.

Sixteen spindle speeds are provided by means of sliding jaw clutches and the faceplate drive pinion. Control of speed changes by sliding-jaw clutches saves space and permits the use of wider faced gears in the headstock. The carriage is designed to bring it into the proper working position quickly and without tiring the operator. The carriage cross-slide length of both models is 32 in. and the width is 21 in.

These lathes are equipped with power angular feed which enables the operator to cut short tapers at any angle, to face bevel gears and the like quickly and uniformly. The "yoke-type" taper attachment will cut 60 in. at one setting.

The boring and turning lathe is equipped with separate lead and boring screws. The boring screw is 4 in. in diameter, and is supported at each cross girth by long, replaceable bearings with ball thrust bearings on the



spindle is mounted on double Timken precision bearings and large bronze intermediate bearings are provided. Continuous lubrication is provided for all bearings and gears in the headstock by a combination splash system and separate lubricating pump and motor located outside the headstock.

The double wall design of the apron provides support both front and back for the rack gear and all studs, with minimum strain on apron parts when feeding. Longitudinal and cross feeds are transmitted by a large-diameter friction clutch, with clutch control levers located on the front of the apron. A positive safety device prevents simultaneous engagement of the feed and the screw-cutting mechanism. Control of lathe operation is provided at the apron by means of a single lever operating through the control rod.

Electrical control units are conveniently mounted on the carriage and must be held constantly by the operator. The carriage traverse stops immediately upon release of the push-button or drum switch control. Reversing and forward action of the tail and headstock ends. For protection against accidental jamming or over-loading, a large shear pin is provided in the coupling between the lead and boring screws. The boring bar saddle uses two V's on the bed. Power is transmitted to the saddle through a bronze half-nut, and is operated by a handwheel. The standard bore of all saddles is 12 in. in diameter which may be readily bushed for smaller size boring bars.

The 50-in. lathe has a 53 in. swing over the ways, while the larger size has a 60-in. swing over the ways. The headstock on both units has a bed length of 71⅞ in. and 6 in. holes through the spindle. Bed measurements of the machine are 46 in. wide and 24 in. deep.

Scaiflux 21 Brazing Flux Suits Any Type Alloy Brazing

Scaiflux 21, produced by Scaife Co., Oakmont, Pa., is a silver-alloy brazing flux that is suited for use in brazing any type of ferrous or non-ferrous alloy. Scaiflux has a low melting point and low surface tension, and spreads evenly over the surfaces to be joined. It is fully active at 900 F. It dissolves all oxides and protects the cleaned surfaces from further oxidation. A wide variation of temperatures is permitted during the brazing process, the flux remaining fixed and active at temperatures above 1,650 F.

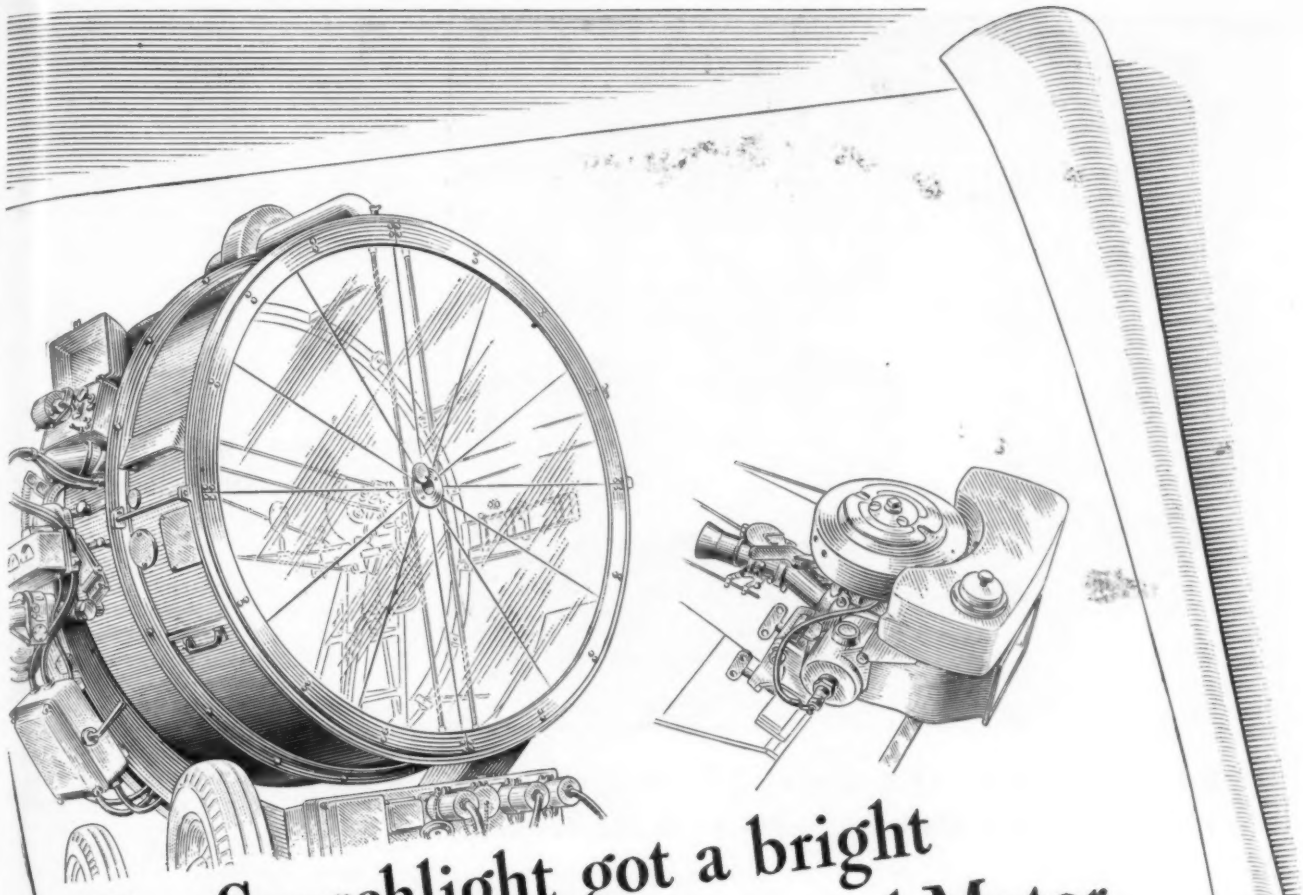
This brazing flux is soluble in 140 F. water, eliminating the need of acids, alkalies or other reagents for cleaning brazed parts. It is available in both paste and dry form.

Noble & Westbrook Marker Made for Cylinder Barrels

Noble & Westbrook Manufacturing Co., Westbrook St., East Hartford, Conn., has announced Model No. 163 high-speed precision marking machine for marking identification data permanently into the periphery of aircraft engine cylinder barrels. It is also suitable for any round pieces having a wall thickness sufficient to withstand the marking pressure, providing the part has a flat end for standing upon the revolving dial. All sizes of parts from ¼ up to 8 in. in diameter can be accommodated on the machine, and the mark can be placed close to the end of the part or up to 4 in. from the end. Solid marking dies or interchangeable steel type can be set up in the die-holder.

The operator places the cylinder barrel on the revolving dial which rotates

continuously and carries the part between the pressure dial and the marking die, where the mark is impressed into the piece and continues around to the unloading point. The dial of the machine is adjustable up and down and the die-holder has some vertical adjustment so that the mark can be made on the piece at the desired distance from the end. The die-holder is mounted on adjustable pressure springs which can be set to give the desired marking depth. The depth of impression can be held uniform on all pieces even though they vary in diameter within a tolerance of 0.050.



The Searchlight got a bright idea from the Outboard Motor

OFFHAND, you wouldn't think there was anything in an outboard motor that could make the going easier for an anti-aircraft searchlight. In designing "outboards," the chief requirements are small space and high load capacity. So builders of outboard motors chose the Torrington Needle Bearing—it's unusually compact for an anti-friction bearing, and noted for high load capacity.

In the anti-aircraft searchlight, size of parts is a secondary consideration, so long as the equipment is transportable. Yet searchlight designers, ever striving for quicker response in locating enemy aircraft, welcomed the Needle Bearing as eagerly as outboard motor manufacturers. And not merely for its high load capacity, which helps prevent overloading and breakdowns, or low coefficient of friction, permitting crews to swing a searchlight's beam into immediate action at the first warning signal.

There's the Needle Bearing's reliable performance, for example—an invaluable feature when enemy planes are overhead—its effective system of lubrication, which enables the bearing to run for long periods without *any* attention at all—and its ready availability, helping to provide our Armed Forces with enough and on time.

THERE MAY BE AN IDEA HERE FOR YOU, TOO, in planning your product's post-war designs. Savings in weight, compact design, infrequent lubrication, dependable operation—these are features your regular customers most likely will insist upon after the war, and the Needle Bearing has every one of them, as well as low cost and ease of installation. Now is the time to "iron out," with the help of Torrington engineers, the details in adapting the Needle Bearing to your particular applications. For preliminary information on sizes, ratings, and typical applications, send for Catalog No. 105.

NEEDLE BEARINGS FOR ALL PURPOSES

LOOSE ROLLERS are produced in a range of sizes for assembly into low-cost, high-capacity anti-friction bearing units. They are particularly adaptable to applications where volume permits installation of the necessary equipment.

NEEDLE BEARINGS are complete, self-contained units consisting of a full complement of rollers and a thin, hardened outer race. They offer the advantages of small size, low cost, high capacity—and are easily, quickly installed.

QUILL BEARINGS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Quill Bearings are adaptable to heavier load requirements than Needle Bearings.

THE TORRINGTON COMPANY

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Makers of Needle Bearings and Needle Bearing Rollers

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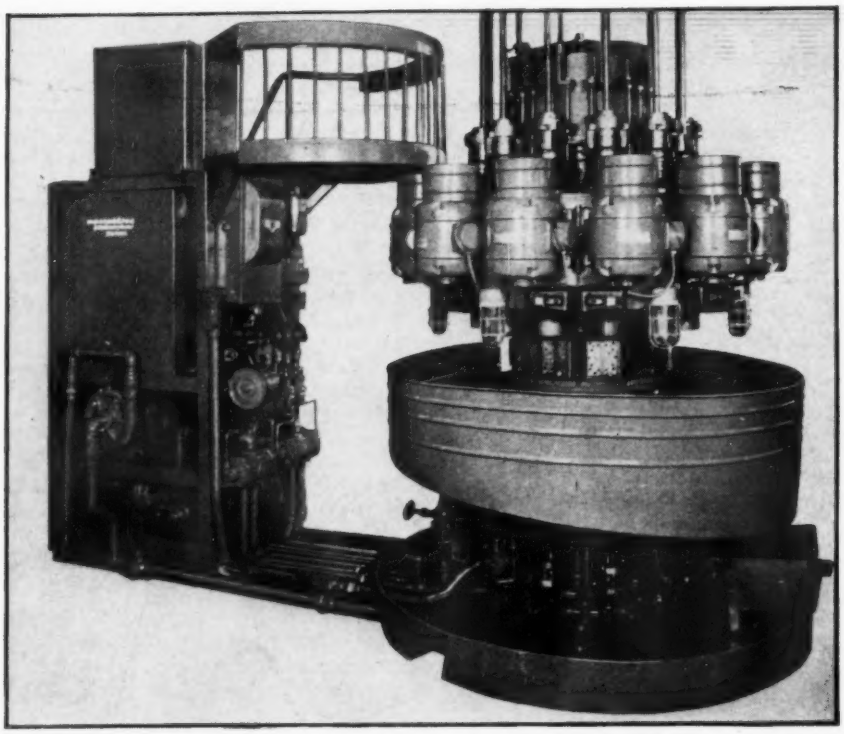
LET'S GO! U.S.A. KEEP 'EM FLYING

TORRINGTON NEEDLE BEARINGS



Togstad Verti-Matic Bar Feed, Chucking Screw Machine Produces Parts From Round, Square or Hex Bar Stock

The Eaglesfield Verti-Matic, a twelve-spindle, vertical type automatic bar feed and chucking screw machine, has been announced by C. I. Togstad Co., Machine Tools Div., Kokomo, Ind. Although designed primarily for fast production of parts from round, square or hexagon bar stock, this machine may also be used for the machining of drawn steel parts of different shapes.

The base of the Verti-Matic is a large cast iron pan with a supporting column running upward from the center. This column serves as a support for the rest of the machine as well as a catch basin for the cutting fluid. The lower turret, which houses the lower spindles with their respective drills, taps or cutting tools, is fastened rigidly to the column at a convenient height for the operator. This turret also carries the stop locator and the manifold supplying the cutting fluid.

The upper turret rotates around the column at desired intervals. Each of the twelve spindles is driven separately by a 2-hp. motor mounted on the outside diameter of the turret. The drive is by V-belts, and the motors are mounted on hinged brackets to provide belt adjustments. Twelve horizontal cutting cylinders are provided directly above the lowest turret with various tools for their respective operations. These cylinders are fastened rigidly to the column in a radial direction and in line with each spindle position. The speed at which the cylinders travel is regulated by means of metering valves.

This machine is operated by hydraulic timing which is adjusted by the simple setting of the split cams to obtain timing desired. The cam shaft is driven by an adjustable V-belt pulley. The tool feed speed is adjusted with a valve for each cylinder, conveniently located under the cylinder. A direct-connected pump forces cooling oil to large manifolds, providing a large supply of coolant. The machine requires a floor space 6×12 ft., and occupies an over-all height of 8 ft. 6 in. The height from the floor to the supply platform is 6 ft. 6 in., and 3 ft. 10 in. from floor to the cutting tools. It will accommodate a maximum of 12 in. stock through the collet. Maximum round collet capacity is 2 in., hexagon 1¾ in., and square 1 7/16 in.

Savage Makes Wooden Case To Hold Doall Gage Blocks

A case has been introduced by Savage Tool Co., 123 Fourteenth Ave., South, Minneapolis, Minn., for Doall precision gage blocks. The box has an advantage in saving space as well as convenience in handling the individual blocks. It holds the standard set of 81 precision gages. Each block is placed at a slight angle in each case so that the etched size marking near the top of each block is readily visible. The proper position for each block in the case is marked corresponding to the size marking on the block.

The case is constructed of solid walnut, treated to insure against acidity from the wood affecting the highly polished surfaces of the gage blocks. Measurements of the box are 11×4½×2 in.

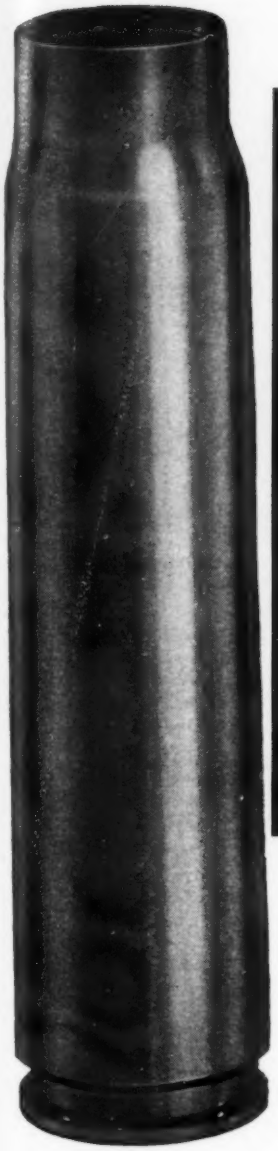
Blount Model B Wet Grinder Grinds Hard Metal and Alloys

The Model B wet grinder, made by J. G. Blount, Everett, Mass., is intended for grinding all hard metals, special alloys, and tungsten carbide. The grinder rest of exclusive design incorporates a coolant ejector. The water is forced against the grinding face of the wheel through a series of holes or jets at the face of the rest. This feature keeps the tools cool and cleans the wheel as it grinds. The entire rest assembly is adjustable for wheel wear.

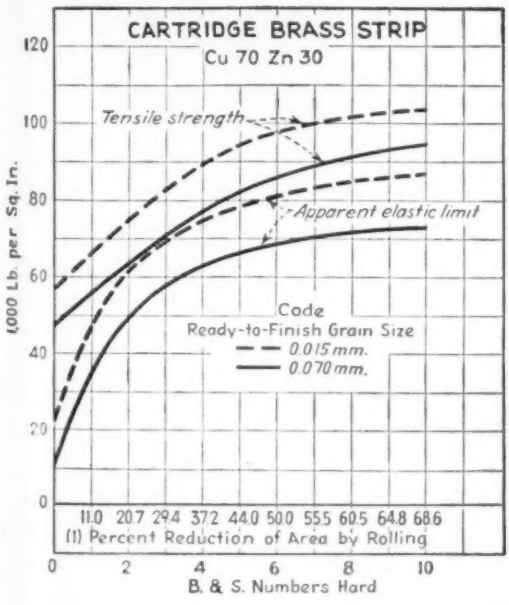
The 2-hp. motor for all standard voltage is totally inclosed and has a manually operated switch with overload motor protection. A treadle-operated switch with spring release can be furnished on the machine if desired. Spindle speed available on this machine is 1,750 r.p.m. A centrifugal motor-driven ball-bearing type pump is provided, and the coolant is pumped through regulating valves to the grinding wheels.

The base of the column of this wet grinder measures 22×19½ in., and the height from the base to the spindle is 37½ in. The pan width is 28 in., and the depth is 4½ in. It is rounded at the corners and finished with a smooth surface for quick cleaning.

Guards are provided of heavy cast iron with hinged covers and adjustable spark protectors. Weight of the machine is 912 lb. The grinding wheels are cup-type, steel back, 12 in. diameter by 2 in. face.



It pays to know the "personality" of CARTRIDGE BRASS



As shown by this chart, control of the ready-to-finish grain size is necessary if uniform physical properties are required in the finished metal.

Most users of cartridge brass know that it has the most favorable combination of ductility and strength of all the brasses, that it can be readily spun, drawn, forged and upset. But many have discovered that even a metal so obliging can have a distinct "personality" of its own which has a bearing on methods of fabrication.

For example, its mechanical properties are markedly influenced by the ready-to-finish grain size — the crystal size obtained by the anneal before the final cold working operation. The chart shown here helps to illustrate the extent of this influence, and the effect of cold working, on the tensile strength and apparent elastic limit of cartridge brass strip, for the smallest and largest grain sizes commonly met in commercial annealing.

This is but a single example of the kind of information with which Revere is prepared to supply users of metals. It is one reason why persistent fabricating problems seldom trouble Revere customers. For copper-base alloys and practical help in using them, get in touch with Revere today.

REVERE

COPPER AND BRASS INCORPORATED

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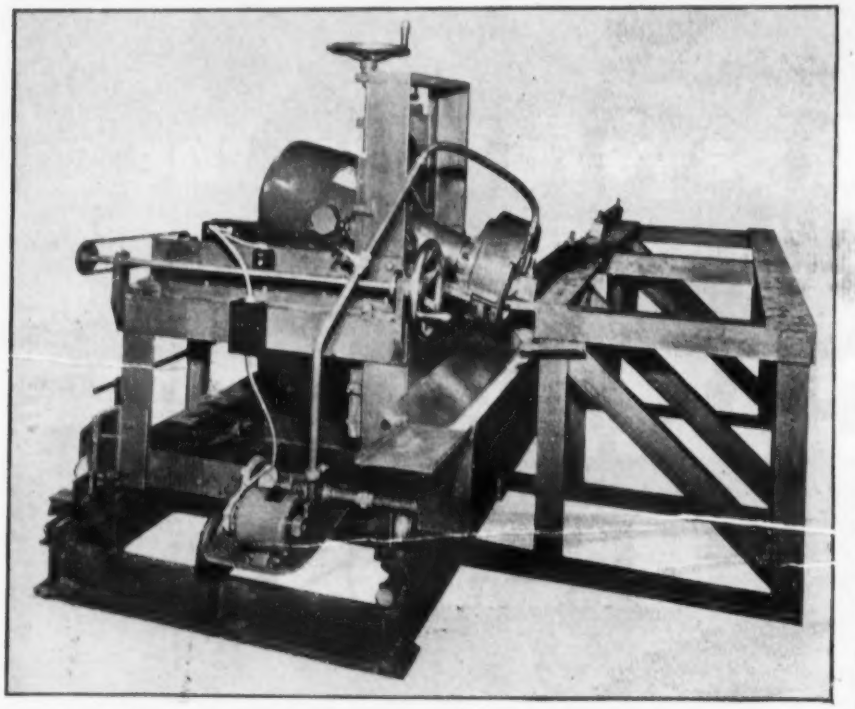
Vonnegut Makes GRC Type Armor Plate Grinder For Straight-Line, Square and Beveled Ends



For grinding straight-line, square and beveled ends and edges of armor plate, a GRC type grinder has been brought out by Vonnegut Moulder Corp., 1819 Madison Ave., Indianapolis, Ind. This machine is constructed almost entirely of welded structural steel sections which permit changes and dimensional specifications without long delay for new patterns. It is available with a 10- or 14-in. diameter segmental abrasive chuck driven by a 7½- or 10-hp. motor respectively. The grinding unit has a 90 deg. angular adjustment.

The track and table are suited for 8 ft. length of work normally, but work may be shorter or longer. The width and height of the work table may also be specified according to the character of work pieces, if the machine is for other use than armor plate patterns.

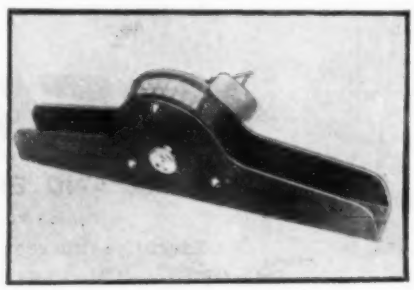
The frame of the grinding unit is supported upon four grooved wheels that roll upon a pair of round steel tracks mounted upon a pair of I-beams. The supporting beams are tied to each other and also to the work table by a series of welded braces to hold these parts in parallel relationship to each other.

In operation the grinding unit is drawn back and forth along the track by a power feed reversing cable drive. The cable drum is driven by a ½-hp. motor. The length of travel is controlled by contact of the unit with adjustable throw collars upon a shifting rod which extends the length of the tracks. Standard rates of feed are 4, 6½ and 8 ft. per min., but three alternate rates of feed may be specified. A coolant tank and pump with ¼ hp. motor are attached to and travel with the grinding unit. The grinding and feed motors are controlled through pushbuttons and magnetic contactors with thermal overload relays and under-voltage release.

Engis Announces Clinometer To Check Machine Tool Angles

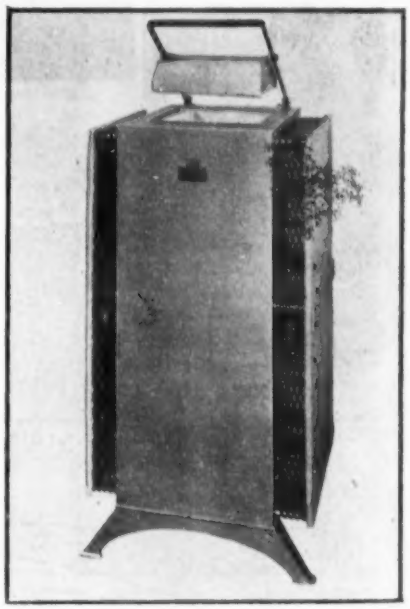
The Clinometer developed by Engis Equipment Co., 310 South Michigan Ave., Chicago, Ill., is suited for many purposes wherever angles and inclinations require checking, such as for use on machine tools and test set-ups in the inspection room. When the device is applied to an inclined surface, the drum swings to a position which brings its center of gravity under its center line. The degrees of inclination can be read on this gravity mechanism from a point located above the drum. Minutes of the arc are indicated by a separate vernier scale.

Reading is facilitated by a brake mechanism, and by an attached magnifying glass which enlarges both the degree and vernier scales. The rotating drum can be locked in position through a hand knob brake. Consequently, a reading can be taken after the instrument has been removed from the measured surface. Since the Clinometer is not sensitive to shock, it can be used in all temperatures. The instrument is available in five models, with special models furnished for testing of airplane propeller blades, and templets. The Model A measures 14×1½ in., and is 4½ in. high.



Doall Develops Steel Ink For Layout Work on Dies

For use in layout work on dies, templets and machine parts, to locate high spots in scraped machine ways, to check gear tooth contact, and to determine relation of mating surfaces, the Doall Co., Des Plaines, Ill., has developed steel ink. It is deep blue in color. It is said that this ink is not easily abraded by the action of chips in machining operations, will adhere to ground surfaces, and is not attacked by machine oil, or the usual cutting and soluble oils. It has quick-drying property, and is removed with an alcohol-moistened cloth. This product is available in 4 and 16 oz. bottles with convenient applicator top.



Sentry Adds Size 4B Model YP To Line of Hardening Furnaces

Size 4B Model YP vertical high-speed steel hardening furnace, made by Sentry Co., Foxboro, Mass., will attain a peak temperature of 2,500 F., has a muffle chamber of 6×6×40 in. Tools up to 4¾ in. in diameter by 36 in. long can be hardened by the Sentry Diamond block method of atmosphere control. The lift type door is arranged to swing up and back away from the muffle opening, and is balanced to prevent the operator from exposure to the hot surface. The terminals are spring mounted and designed for efficient air cooling. All electrical contacts are shielded and provided with safety guards.

A Few Products of QUAKER CHEMICAL RESEARCH:

New type cutting fluids to replace oils on all machining operations.

•

Wax, grease and oil-type corrosion resisting coatings.

•

Products for cleaning and rustproofing in one operation.

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Water soluble solvents to replace degreasers and alkaline baths for metal cleaning.

•

Modern emulsoid solutions for grinding.

•

Compounds for drawing, stamping and forming of all metals.

•

Special chemicals and oils for every metal processing operation.

Quaker Chemical puts the

EMPHASIS ON RESEARCH

Develops products and processes to overcome problems heretofore inadequately dealt with

MORE THAN a decade ago, we at Quaker Chemical dedicated our organization to the task of locating processing problems in industry which we felt have never been handled quite satisfactorily . . . and to developing chemical products and processes that would overcome past troubles.

So, today, the heart of the Quaker Chemical organization is its laboratory—or, rather, its laboratories—for there are *two* separate "labs" at our Conshohocken plant. One, the Control Laboratory, inspects all incoming raw materials as well as our own finished products. The other, a corner of which is shown above, is devoted entirely to research and development.

Heading these two "labs" is an eminent scientist who has studied at four leading universities, both here and abroad, and who has personally been granted more than 40 practical patents.

The Research group comprises more than 25 chemists and engineers . . . most of whom have accompanied Quaker Process Engineers on their field service calls and are, therefore, familiar with metal processing and are able to envisage the practical side of every shop problem. Their work—which consists of both special problems and permanent projects directed toward basic research in corrosion, cutting, drawing and similar propositions—is carried on in a large, modern, open laboratory where every individual knows the work of the others. Whenever difficulty warrants consultation, informal round-table discussions are called at a moment's notice.

In addition to the work of this group, Quaker Chemical also maintains fellowships and sponsors research projects in five leading universities.

Probably no other similar manufacturing organization devotes so large a proportion of its facilities and energies to research. That this policy has borne fruit is evidenced by the many new type Quaker Chemical products that have already won wide acceptance throughout industry.

Just how far-reaching will be the effect of some of these developments on metal processing remains to be seen. In some cases their performance has been truly outstanding . . .

But rather than make extravagant claims for these products, we prefer to use this method of inviting you to establish contact with us . . . so that your plant may share immediately in whatever benefits emerge from Quaker's never-ending research.

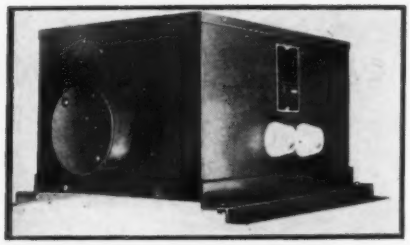
A Quaker Process Engineer will gladly call and discuss with you just where our new developments may fit into your metal working picture. Simply write or wire—

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

OTHER PLANTS IN CHICAGO AND DETROIT

WAREHOUSE STOCKS IN PRINCIPAL INDUSTRIAL CENTERS



Acme Cold Cathode Transformer Has War-Plant Lighting Use

A cold cathode lighting transformer, especially designed for industrial application has been developed by Acme Electric & Manufacturing Co., Cuba, N. Y. It is a heavy-duty, vibration-proof unit with standard conduit box for primary connection and built-in parallel electrode housing for direct connection to cold cathode tubes. Capacity of the unit is 120 miliamperes in 3,000, 4,000, 6,000, 9,000 12,000 or 15,000 volt secondaries.

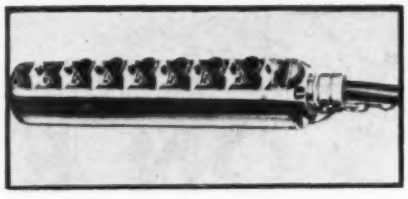
Industrial Dust Collector For Magnesium Processing

A dust collector for processing of magnesium had been made available by Industrial Equipment Corp., Detroit, Mich. The fan unit is the only mechanical moving part. The unit is available for use in either booth type or individual collectors for grinding stands.

Dust-laden air is drawn through an orifice causing a heavy spray of water. The dust is water-whirled out of the air and knocked down into a tank below where it forns a sludge which is easily removed. Operation of the Hydro-Whirl permits the cleaned air to be returned to the room, thus making for saving in heating posts.

Northern Pushbutton Battery Has Up to Five Speeds Each

A multiple-speed pushbutton which provides up to five speeds on any button has been developed by Northern Engineering Works, 2615 Atwater St., Detroit, Mich. A battery of these buttons is mounted in a pendant. Each button provides from one to five speeds on the device controlled. As the button is pushed in, it moves a metal cylinder to wipe over a succession of contacts. The contacts are steel balls mounted on springs, stiff enough so the operator can feel the successive clicks.



While designed primarily for crane and hoist operation, this pushbutton is adaptable to any machine where pilot or relay circuits are used.

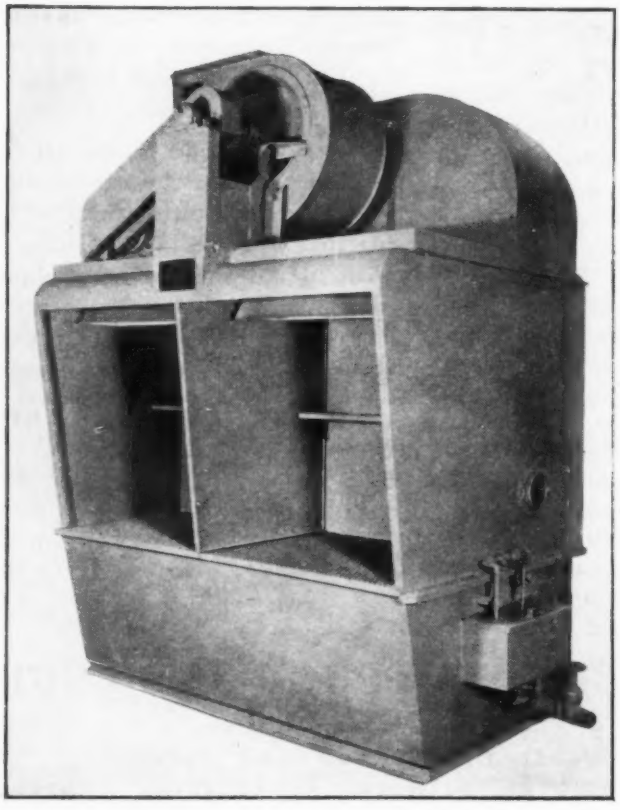
Grip-On Pulley Lagging Available in Two Widths

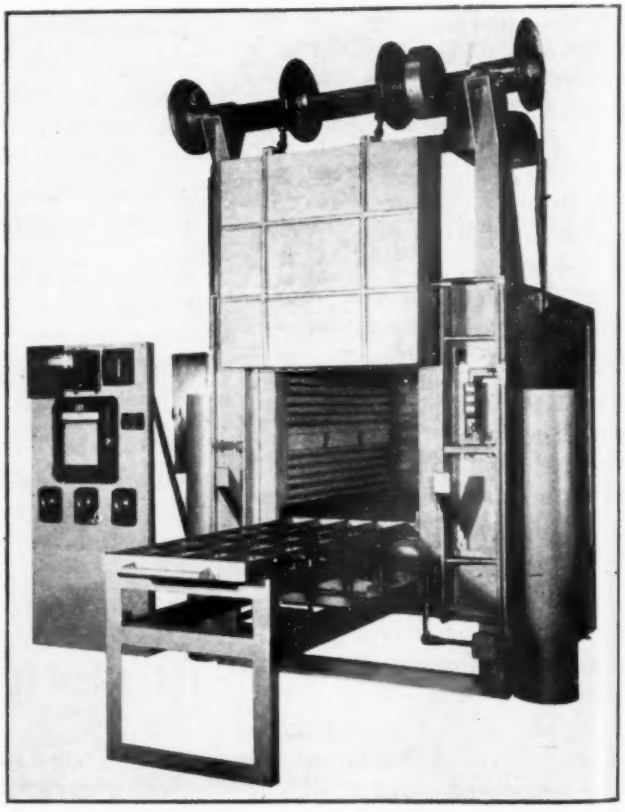
Grip-On pulley lagging has been developed by Victor Balata & Textile Belting Co., Easton, Pa., for straight or crown face elevator, conveyor, and power transmission pulleys. The pile-face surface, designed to promote better traction and longer belt life, is woven as an integral part of the lagging body, yet imparts no tension strain to the base which maintains a snug fit on the pulley. This solid woven base prevents bolts or screws from pulling out. Grip-on is available in 2½ in. widths, and is suited for spiral application. A wide type lagging can also be furnished, which is cut either square or with a bias joint when applied to pulleys.

Swoboda Heat-Treating Furnace Built for Higher Temperatures

A box-type furnace for general heat-treating at temperatures up to 2,000 F. has been added to the line of Falcon furnaces built by H. O. Swoboda, Inc., Thirteenth St., New Brighton, Pa. Originally designed for stress relieving only, the BRP-A unit features a push-button controlled, motor-operated door opening and closing mechanism. A heater cut-out arrangement automatically connects and disconnects the furnace upon opening or closing.

The furnace is available in chamber dimensions up to 30 inches square by 4 ft. 6 in. deep. It is equipped with an excess temperature safety feature to prevent burn-out if the controls should fail. Standard equipment includes an on-off type pyrometer control with input regulator for varying the input, to secure any desired heating, holding and cooling program. A time clock installation is provided for turning on the equipment at any predetermined time.





KENNAMETAL'S* RULE 6 For Reducing Tool Consumption

PROPERLY BRAZE KENNAMETAL* TIPS TO RECLAIMED TOOL SHANKS

S-100 S-200 S-300

Your tool consumption can be greatly reduced by the proper brazing of Kennametal steel-cutting carbide tips to steel shanks or to some of those used shanks that have accumulated through the years. Kennametal tools can be made in your shop within a very few minutes by use of the torch brazing technique.

For most efficient results from tools produced in your shop, proper brazing is essential. The following instructions on how to braze these tools will help to give you that efficiency and reduce your tool expenditure.

STEP 1. PREHEATING SHANK

. . . A good quality brazing rod or silver solder are used in torch brazing. The shank is heated at recess with borax or prepared flux. A non-oxidizing flame must be used in brazing and care must be taken to avoid burning or oxidizing the KENNAMETAL blank or the shank.

STEP 2. APPLYING BRAZING MATERIAL TO SHANK

. . . When flux runs freely, recess should be "tinned" by touching a 1/16" rod of brazing material to it, allowing it to melt and run freely over the surface of the recess. The KENNAMETAL blank may then be placed in the recess with tongs or pliers. If silver solder sheet is used, it should be applied when the tip is put in place.

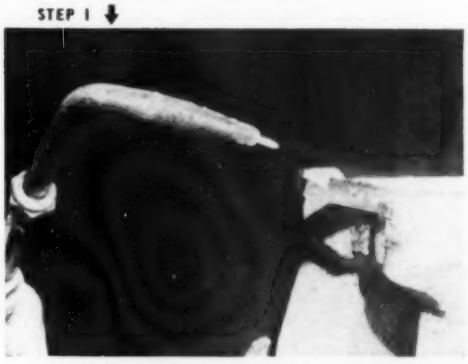
STEP 3. APPLYING TORCH AFTER TIP IS IN PLACE

. . . Cover with flux and heat the underside of shank with torch until flux and brazing material are again melted. Finally the torch may be applied to top of tool.

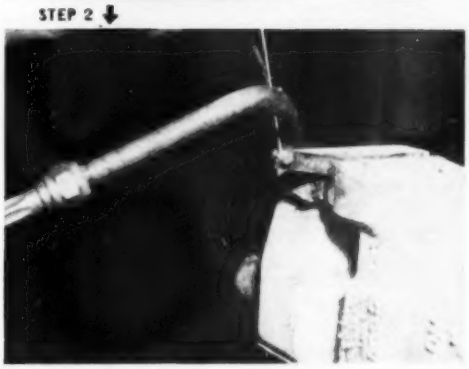
STEP 4. PRESSING TIP INTO PLACE

. . . Press KENNAMETAL tip firmly into place with tang of file or other instrument and hold it until brazing material has solidified. Allow tool to cool slowly and when quite cool, grind as necessary for the operation to be performed.

STEP 1 ↓



STEP 2 ↓



STEP 3 ↓

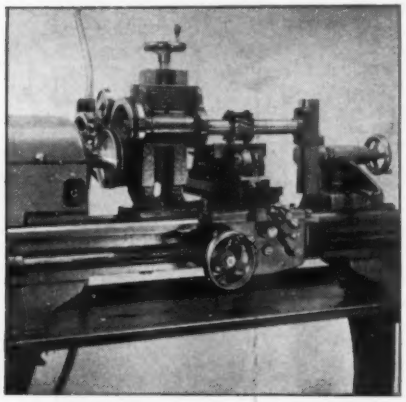
STEP 4 ↓

*INVENTED AND MANUFACTURED IN U. S. A.

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PA.
Trade Mark Reg. U. S. Pat. Off.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)

Globe Miller Converts Lathe To Perform Milling Operations

Plain and angular milling, slotting, slitting, dovetailing, rack cutting, keyway cutting, and various other types of work can be performed on the Globe miller, made by Globe Products Manufacturing Co., 3380 Robertson Blvd., Los Angeles, Calif., which is designed for attachment to standard lathes. It can



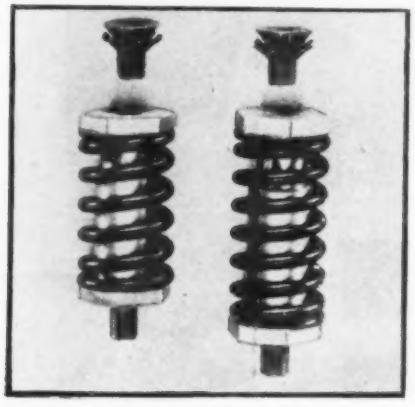
be mounted on a lathe in a few minutes and utilizes the lathe headstock as a power source. All speeds and feeds of the lathe are thus permitted to be used in the milling work.

In addition to performing a wide range of milling operations, the attachment increases the swing of a lathe from 5 to 10 in., depending on the size of the machine. Thus turning operations, such as truing brake drums, too large to be handled on the lathe, are made possible.

Strippits Allow Removal of Stripper Plate Without Dies

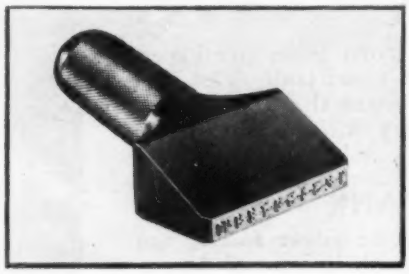
The removal and replacement of a stripper plate without taking the die out of the press or disturbing any part of the set-up can be accomplished by use of the improved Strippits, spring-stripping units, introduced by Wales-Strippit Corp., North Tonawanda, N. Y. These units provide equal pressure around the entire stripper plate.

Strippits are self-contained and self-aligning units in which the built-in spring is held compressed by a retainer and assembly link. One end of it has a screw thread which holds the Strippit to the punch or die shoe, and the other end has a tapped hole for a screw to hold the stripper plate to the unit. They are available in lengths from 2½ to 6 in.



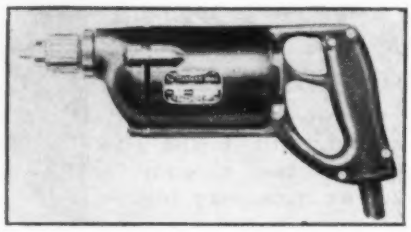
New Method Sequence Stamp Simplifies Parts Inspection

An operation sequence marker has been produced by New Method Steel Stamps, Inc., 143 Jos. Campau St., Detroit, Mich., which provides a simple system of marking parts in process, so that a complete history of the part through the various manufacturing operations and inspection can be obtained. It is a hand stamp carrying a number of consecutive numerals, the number of numerals being the same as the number of operations for which inspection is required. These numerals are im-



pressed on a casting, for instance, immediately after a snagging operation.

Each inspector is assigned a stamp carrying a specific letter of the alphabet. After each operation, the inspector involved marks the part above or below the numeral corresponding to the operation he is checking. If he passes the part, he puts his mark below the number, and if he rejects it, he puts his mark above the numeral. Then, when the operation is performed correctly, and the part becomes acceptable, he places his mark below the numeral. In this way, all the facts are readily visible and easily understood by anyone familiar with the system. Many other checks can be worked out by using this method of marking.



Black & Decker Electric Drills Have Drillite Plastic Housing

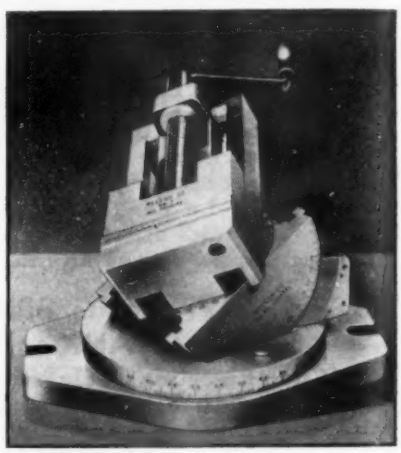
Drillite plastic housing has been developed for the ¼- and ⅜-in. electric drills made by Black & Decker Manufacturing Co., Towson, Md. The plastic is heat-resistant, and insulated against electric shock, and is made with a shredded cotton duck base. Steel air vents in the commutator end housing provide ventilation.

Both units are offered with end or side handle control, equipped with pistol grip and trigger switch, and with universal motors.

Wesson Vise and Angle Plate Suits Many Kinds of Machining

A universal precision vise and angle plate has been introduced by Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich., in two sizes for machining operations involving any angle with toolroom accuracy at high production speeds. The No. 1 has a jaw opening up to 4 in. and is 6⅛ in. high, while the No. 2 has a jaw opening up to 1⅜ in., and is 4⅜ in. high over-all.

Both sizes may be equipped with angle plates for parts that are too large or of a shape which is too irregular to be held securely in the vise. The unit can be mounted by T-bolts to any type of machine and



may be moved from one machine to another without disturbing the angle or removing the work, thus permitting a series of operation at the fixed angle required.

The vise swings 180 deg. in the top plane, 90 deg. in the vertical plane, and 360 deg. on the bottom plane, and is completely graduated in all planes. Vernier graduations are available for use where extreme precision is required.

Sturtevant Spring Tester Measures Recoil Pressure

A recent development of P. A. Sturtevant Co., Addison, Ill., is a tool for testing compression springs in sizes to 2½ in. in diameter and 7 in. in length. With this tester it is possible to match sets of springs as well as measure the recoil pressure of a spring when compressed to any predetermined length.

The tool is operated with any standard torque wrench which serves as the operating lever and also provides the

Now FAST DELIVERY OF ALL TYPES OF ROUND BROACHES

FROM

Colonial's NEW PLANT

ALSO *FAST* DELIVERY ON PLAIN FLAT BROACHES

In Colonial's new plant are to be found greatly increased facilities for the production of broaching machines and broaches, particularly for round and plain flat types. As a result we are currently in a position to supply all round broaches and plain flat types in a matter of weeks instead of months. And this in spite of the fact that Colonial's total volume of broaches is vastly greater than ever before and quality still higher.

1918—25TH ANNIVERSARY—1943

colonial BROACH COMPANY

Broaching Machines — *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

measuring element. In this tester a sound device is used to indicate when the spring has been compressed to the test point, thus eliminating the need for watching multiple dials. The unit is so arranged that it may be bolted to any bench.

Although developed originally as a means of accurately matching valve springs of airplane and automotive engines, the spring tester is also suitable

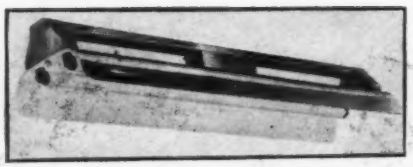
for proof-testing strength of press fits, and for light arbor press production operations where they permit the rapid application of accurately gaged pressures.

It can be adjusted for any test by regulating the height of the test platform to match the length at which the spring is to be tested. This platform is mounted on a threaded column and is raised or lowered by revolving. A milled flat on the column carries a stamped scale calibrated to 0.16 in. Adjustments to 1/16 in. of platform height for test lengths can be read directly on this scale. For finer adjustments one-quarter turn of the platform raises or lowers it 1/64 in., the surface of the platform being marked for readings of 1/64, 1/32 and 3/64 in. The periphery of the platform is divided into 21 ridges for finer adjustments of test lengths to 0.003 in.

When the torque wrench has been attached, springs are tested by placing them on the platform and pulling down on the wrench. When the point is reached at which the recoil pressure of the spring is to be measured, the tone device sounds.

Mitchelite Fluorescent Fixture Made to Join in Continuous Row

A fluorescent lighting fixture known as Mitchelite is offered by Mitchell Manufacturing Co., 2525 N. Clybourn Ave., Chicago, Ill. Units can be joined end to end in continuous rows with the new type easy-fit wireway channel that permits locating the ballast on the outside. This results in greater air circulation, cooler operation and longer life of the ballast. The starters and sockets are made easily accessible without disturbing the lamps.



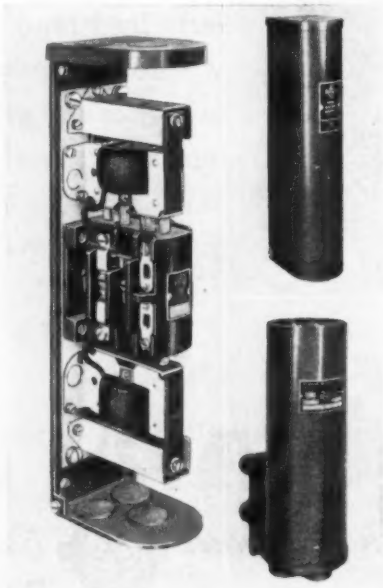
The Lumenite non-metal reflectors are specially treated, making them moisture and high-heat resistant. The reflectors can be installed or removed from the end pieces by a few turns of wing nuts.

This model measures 50×14 in. by 9½ in. high. The four models available include two-light and three-light units using 40-watt lamps, two-light units using 100-watt lamps, and two-section units for four 100-watt lamps, which operates with only one ballast.

Furnas Reversing Switch Is a Single Compact Unit

Single unit construction instead of two separate contactors is a feature of the improved 5-hp. magnetic reversing switch brought out by Furnas Electric Co., 438 McKee St., Batavia, Ill., which allows for reducing the switch to a compact size and eliminates internal wiring. It is across-the-line type that permits reversing control of the motor by use of a pushbutton near or at a distance from the switch or motor. This provides a convenient method for operating many types of equipment requiring pilot devices such as limit switches.

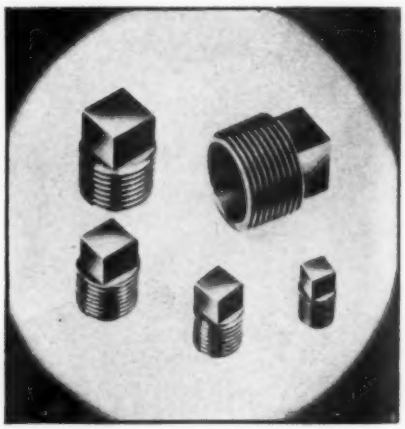
The unit consists of one contact assembly and two magnets to operate the movable contacts. The sides and cover of the inclosure are one piece. This switch is available for operation on 110, 220, 440 or 550 volts, single or three-phase motor. Low-voltage protection (three-wire control) or low-voltage release (two-wire control) is obtained, depending on the pilot device used. Electrical interlocks are provided on the switch when low-voltage protection is required. The advantage of this type of control is that the machine will not restart after a voltage failure until the operator closes the start contacts. In the case of low-voltage release, the machine will restart automatically as soon as the power is restored. The control circuit is usually connected directly to the main power circuit, but the switch can be furnished for use with a separate voltage supply. It can also be provided with a step-down transformer.



The standard reversing switch is made for vertical mounting, but it can be made for horizontal mounting by a change in the switch. The over-all size is 12⅜×3¾×3 in.

American Plastic Pipe Plugs Provide Protection From Damage

Plastic pipe seal plugs to provide protection for threads of units in storage or in transit has been developed by American Molded Products Co., 1644 North Honore St., Chicago, Ill. These light, durable, non-corrosive seals form



a protection against damage, moisture, dirt, rust and corrosion. They are furnished in sizes ⅜, ½, ⅝, ¾, and 1 in., with other sizes available.

Lloyd's Flux Will Solder Stainless Steel at Low Heat

An excessively hot iron is not required to solder stainless steel when using its flux, according to the Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago, Ill. As a consequence it is claimed that there is no heat stain on the work. Operator complaints are avoided because the material does not throw off acid fumes.

The flux, which is also used to solder other metals except aluminum, does not creep on the stainless steel surface. Although soluble in water to remove any surplus, the product does not contain water, and hence does not spatter or spray when the iron is applied. One application of the flux will cause 50-50, 60-40, 95-5, or any of the soft solders to adhere evenly to the seam and flow into the pores of the material. High

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belongs on one of these
No. 3-A
DUOMATIC
LATHES
Write for comprehensive descriptive
Bulletin No. 601
Proudly worn since
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CINCINNATI, OHIO, U.S.A.
ENGINE TOOL ROOM AUTOMATIC LATHES

capillary action of the flux is said to induce the solder to penetrate uniformly into all types of seams, and thereby avoid flux pockets to corrode. The material is available in pint, quart, half gallons and gallons, as well as 5 gal. sizes.

Superseal Tubing Connector Suits All Types of Tubing

For use on oil, gas, air, chemical and other lines, Grinnell Co., Inc., Superseal Div., Providence, R. I., has brought out a Superseal tubing connector which is adaptable to use with all types of tubing. A long 10 deg. tapered cone provides greater seating area for tubing flare, assuring a leakproof joint. This fitting can be used with welded, brazed or seamless steel tubing, and all non-ferrous tubing. It is made in sizes up to and including ½ in. outside diameter in steel, and of malleable iron in sizes ⅝ in. outside diameter and larger. The connector has a Parkerized wax finish.

Safe-Aire Dust Collector Built for Portable Use

To supplement larger, permanent dust control systems, or to serve in place of such systems when necessary, Bargar Sheet Metal Co., Cleveland, Ohio, have brought out a portable dust collector known as the Safe-Aire, for which Ralph Maitland, 435 Penton Bldg., Cleveland, Ohio, is sole agent. It is suitable for collecting dust from a single grinder or other dust-making machines, separates the dust from the air, and blows the clean air directly back into the shop. It will handle dust from two 9 in. grinding wheels whether they are mounted together or separately, and can be attached to two separate machines.

The dust collector has a capacity of 600 cu.ft. per min., and is operated by a ⅛ hp. motor. It sucks the dust-laden air and forces it at high speed into a miniature cyclone which precipitates the heavier dust into a hopper and throws the lighter dust into a filter chamber. The air is then forced through a spun glass filter and directly back into the shop.

The working parts are housed in an all-welded, streamlined metal cabinet with a black wrinkle finish. All parts except the motor and blower are fabricated from lightweight sheet steel. The machine stands 37 in. high, is 27 in. wide and 13 in. deep. A short length of piping attaches dust collectors to machine guard or hood. Unit weighs under 120 lb.

Stackbin Spare Parts Box

A spare parts box, available in a variety of sizes and styles to meet many different requirements of plants shipping parts with their products for military use, is offered by Stackbin Corp., 42 Troy St., Providence, R. I. The box is of all-welded construction and is equipped with a cover and handles.

NEW MATERIALS

Ampcoloy 45-22 Bronze Now Made in Extruded Form

The AMS 4640 bronze, a high-iron, high-nickel aluminum bronze often used in aircraft production, is now being supplied in extruded sections by Ampco Metals, Inc., Milwaukee, Wis. Formerly the material, known as Grade 45-22 of the Ampcloy series, was available from the company only in the form of castings.

Specifications normally require that this alloy be heat-treated. Extruded sections can be supplied in lengths up to 30 in. Mill lengths can be supplied, however, if the user will waive the heat-treating requirement, and permit the producer to obtain the specified hardness by adjusting the composition and method of fabrication. Physical properties of the bronze, extruded and heat-treated are:

	Under 1 In.	1–2 In.	Over 2 In.
Tensile	105,000	100,000	95,000
Yield	55,000	50,000	50,000
Elon.	8	10	12
R. A.	8	10	12
Brinell	229	217	207

Koroseal Sheets Developed For Tank Lining Application

Koroseal tank lining has been developed by B. F. Goodrich Co., Akron, Ohio. Made in sheets, the lining can be applied in thickness up to and including 3/32 in. It is said that this material is not subject to physical damage and pinhole leaks suffered by many corrosion-resistant paints. It has electrical resistivity and prevents current losses in electrolytic action. It is said to be resistant to oxidation, water, sunlight, gas diffusion and inert to strong corrosives. The Koroseal is a synthetic elastic material with many rubber-like properties.

TRADE PUBLICATIONS

BROACH SHARPENER Bulletin CS1-43 contains illustrations, descriptions and general specifications of the Type CS1-72 broach sharpening machine of the Colonial Broach Co., P. O. Box 37, Harper Station, Detroit, Mich.

BUSHINGS An 84-page catalog listing sizes and prices of hundreds of finished bronze bushings and porous oil-retaining bearings may be obtained from Atlas Brass Foundry, 1901 Santa Fe Ave., Los Angeles, Calif.

CRANES A booklet for new crane operators entitled "Controlling Crane Hooks," Catalog No. 213 containing illustrations, descriptions and outline dimensions of standardized production built cranes and Catalog No. 214 on multi-motored overhead electric traveling cranes have been published by Manning, Maxwell & Moore, Inc., "Shaw-Box" Crane Div., Muskegon, Mich.

GEARS The Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa., offers a 72-page combination catalog and gear data book, No. 42, containing tables of dimensions for various types of gears, data on speed reducing units, MotoReduceRs and electric hoists, and an engineering data section.

GRINDING Four folders on surface grinding, internal grinding, cut-off operations and high speed snagging are offered by The Sterling Grinding Wheel Division of The Cleveland Quarries Co., Tiffin, Ohio.

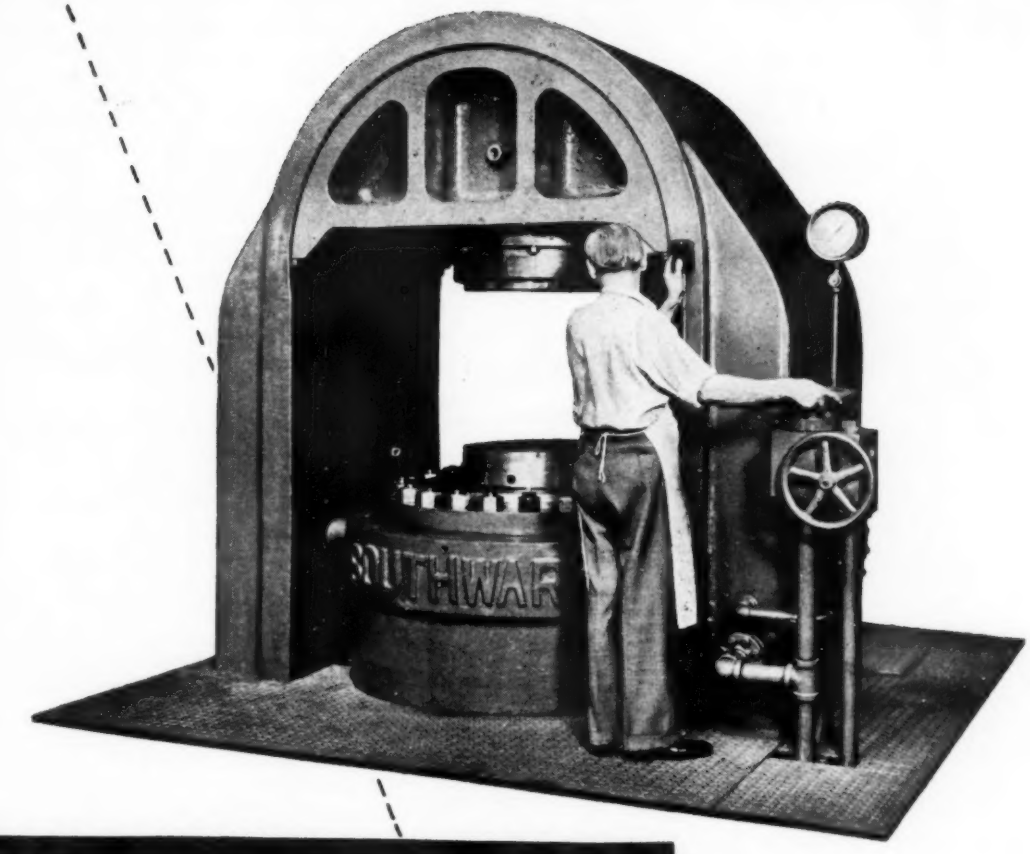
INDUCTION UNITS The story of induction heating, its scope, possibilities and advantages, are covered in the bulletin issued by Van Norman Machine Tool Co., Springfield, Mass.

INSPECTION The George Scherr Co., 128 Lafayette St., New York, N. Y., has issued a 4-page folder describing their Limited Budget Inspection Laboratory and 14 types of measuring instruments, tools, gages and optical inspection devices.

INSPECTION Folder No. 20, illustrating and describing the adjustable arm Inspecto-Scope for continuous production inspection and the portable Inspecto-Graph for use anywhere in the plant, is available from S. Lowe & Sons Co., 20 Sanford St., Fairfield, Conn.

MILLING The Cleveland No. 1½ horizontal production milling machine is illustrated and described and general specifications are given in the folder issued by The Sommer & Adams Co., 18511 Euclid Ave., Cleveland, Ohio.

METAL PRODUCTS A 20-page booklet printed in two colors, gives a pictorial presentation of the products and services of the V. E. Sprouse Co., Co-



FOR DIE-HOBBING

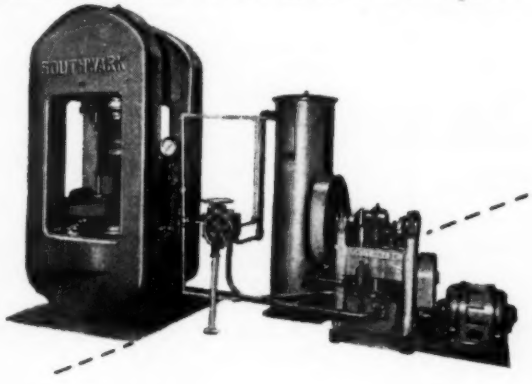
Southwark Hydraulic Presses

Close control, smoothness in power application and rugged dependability are built-in features of Southwark hydraulic presses. These qualities are indispensable for accurate die-hobbing.

Sound design, good materials and honest workmanship are part of every Southwark press. Southwark's years of press building experience are paying real dividends to the leaders in the plastics industry now that uninterrupted production is all-important.

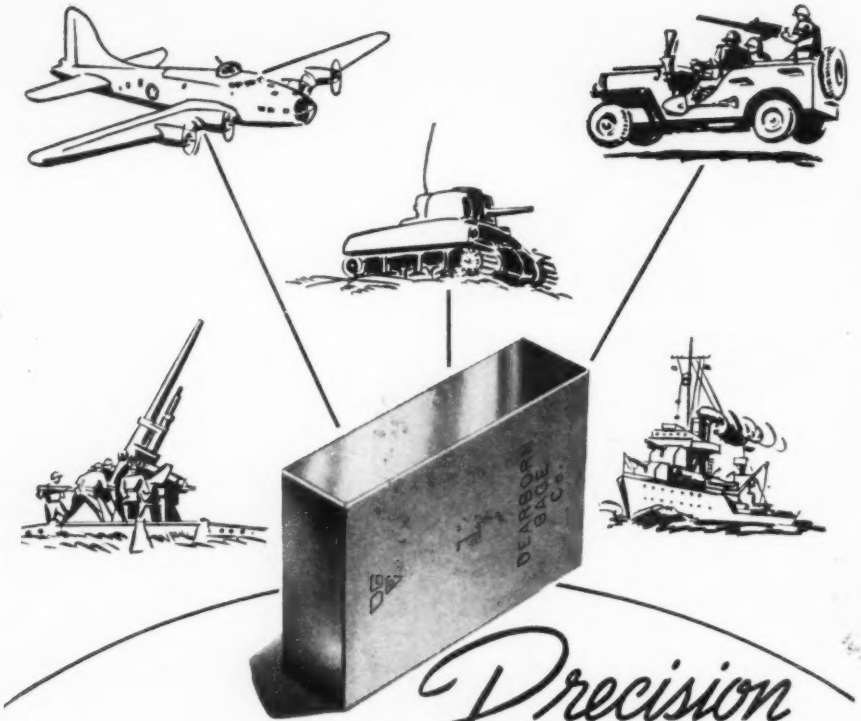
When you're planning new plant equipment for the competition of tomorrow it will pay you to specify Southwark.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.



BALDWIN SOUTHWARK

Division THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa.



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THE BASIS of all precision made equipment, whether it be for war or peace, is the standard of measure—the gage block.

However, the gage block can be truly called the standard only as long as its accuracy is maintained. Without this quality it becomes useless and even dangerous—a potential saboteur of war production. American manufacturers, alert and on the job, know the havoc that can result from undersized gages. That is why today they specify gage blocks by Dearborn. They are chromium plated to assure "longer wearing millionths" and are unconditionally guaranteed for accuracy.

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Dearborn's Set No. 81 illustrated here is available in three standard degrees of accuracy.

WORKING SETS—Guaranteed tolerance of ±.000008 inch.

INSPECTION SETS—Guaranteed tolerance of ±.000004 inch.

LABORATORY SETS—Guaranteed tolerance of ±.000002 inch.

★

lumbus, Ind., a firm that specializes in design and production of small metal parts and complete assemblies of entire machines made from such parts.

MOTOR CONTROL How to select and apply motor control is explained in "Simplified Guide to the Selection and Application of Commonly Used Motor Controls," 16-page manual GEA-4015 offered by General Electric Co., Schenectady, N. Y.

MOTORS "American Electrical Standards for Fractional Horsepower Motors," a 28-page, illustrated, pocket-sized handbook of definitions of terms and motor parts, speeds and duty classifications, motor types and standards, is offered by The Dumore Co., Racine, Wis.

PIPING "Piping Pointers" Bulletin No. 6, "Short-Cuts to Faster Piping Jobs," is one of a series designed by Crane Co., 836 S. Michigan Ave., Chicago, Ill.

PREPARED ATMOSPHERES Folder SC-107 entitled "The SC Primer of Prepared Atmospheres," published by Surface Combustion, Toledo, Ohio, discusses the different types of furnace atmospheres, their preparation, application and relative cost.

PRESSES Machines in the Bliss, Toledo and Consolidated line of straight-side single crank presses ranging in capacity from 20 tons to 2,500 tons, are described and illustrated in a 21-page catalog of E. W. Bliss Co., 53 St. and Second Ave., Brooklyn, N. Y.

RUBBERFLEX Bushings, Inc., 8-155 General Motors Bldg., Detroit, Mich., has published a folder on Rubberflex bushings, available in torsional type, for oscillating movement and protective type, to insulate bearings, and mountings available for horizontal or vertical deflection.

STEEL A booklet entitled "Selecting the Right Steel for Plastic Molding" is available from the Crucible Steel Company of America, 405 Lexington Ave., New York, N. Y.

TIMER Bulletin 3000, a 4-page folder of The R. W. Cramer Co., Inc., Centerbrook, Conn., contains information on applications, construction, standard features, special features, method of calculating complete timer list price and timer dimensions.

WELDING Advantages of hard-facing weld rods are outlined in the bulletin prepared by Coast Metals, Inc., 1323 Camden Ave., Canton, Ohio.

WELDING POSITIONER Bulletin No. 131 of the Lyon-Raymond Corp., 1145 Madison St., Greene, N. Y., illustrates and describes hydraulically operated welding positioner, welding tables and single-speed and two-speed foot pumps.

CASTINGS A 32-page booklet issued by The Hamilton Foundry & Machine Co., Hamilton, Ohio, describes and illustrates some 200 different types of castings produced in both gray iron and Meehanite. This bulletin, No. 1, is entitled "Quality Castings."

CHAINS The 32-page catalog of the Diamond Chain & Mfg. Co., Indianapolis, Ind., designated as Engineering Data Book No. 643, Aircraft Edition, is a guide to correct and safe procedure for the selection, installation, and maintenance of precision roller chains and sprockets for aircraft.

CHART McKenna Metals Co., 126 Lloyd Ave., Latrobe, Pa., offers a chip breaker wall chart to metal machining plants using carbide tools. The chart presents dimensional diagrams for the correct grinding of parallel, angular and groove type chip breakers, together with photographs showing kinds of chips resulting from their use.

CLAMPING TOOLS Photographs, dimentioned drawings and descriptions of vertical handle, horizontal handle, adjustable base and cam action toggle clamps, pliers, "C" clamps, vise grips and vises are included in the catalog of Knu-Vise Inc., 2200 Eighth St., Detroit, Mich.

CLUTCHES Engineering data on Maxitorq multi-disk floating plate friction clutches is given in a 17-page booklet issued by The Carlyle Johnson Machine Co., 52 Main St., Manchester, Conn.

COATED ABRASIVES "Blueprint for Faster Better Production With New Coated Abrasives" is the title of a pocket-size booklet issued by Behr-Manning, Troy, N. Y., illustrating and describing ready-to-use shapes of Metaliite cloth.

COMPRESSORS Bulletin 6211 on Ro-Flo compressors and pumps of the sliding vane type, released by Allis Chalmers Mfg. Co., Milwaukee, Wis., contains a complete engineering description supplemented by installation diagrams, curves showing the relationship between pressure, temperature, and volume, photographs and action views.

CONSERVATION "Wartime Conservation," a 96-page booklet published by Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh, Pa., designated as B-3206, covers up-rating of motors, thermal temperature loading of transformers, industrial network systems, line equipment and materials; and gives tips on saving and salvaging materials.

CONTOUR SAWS In the 265-page, pocket-size textbook offered by the Doal Service Co., 1201 Thacker St., Des Plaines, Ill., methods used to find the best type of saw, saw velocity and feed

How to Get Action on STEEL!

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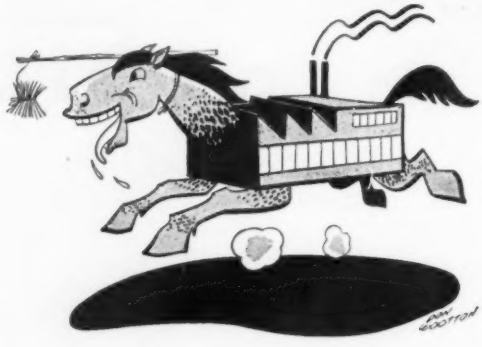

WHY INCENTIVES?

Labor wants incentives to make more money.

Management wants incentives to increase production.

Incentives will not take the place of good management. That would be getting the cart before the horse, for "labor is just as efficient as management plans for it and provides the tools with which to work."

Therefore, before initiating an incentive program management must assume certain responsibilities in order that the results required of incentives will be forthcoming. Some of these are: good material control, good production control, good tool control.

Then and only then, can manufacturing operations be analyzed to determine the most suitable type of incentive and the most desirable method of putting it into effect.

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pressure for cutting any material are illustrated and discussed and specific information given on machine tools and machine shop practice for the student or learner.

CONTROL PANELS The 15-page catalog describing the Homo Nitriding Method, is offered by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

CONTROL PANELS The 15-page catalog of Vickers Inc., 1400 Oakman Blvd., Detroit, Mich., contains sections on operation, features, installation and operating instructions, shows typical applications and installation and dimensioned drawings of traverse and feed cycle control panels.

COPPER "Machining Copper and Copper Base Alloys" is the title of the 32-page booklet, Publication B-3, offered by The American Brass Co., Waterbury, Conn., to assist the plants machining copper, brass, bronze and nickel silver.

COUPLINGS A few of the many uses for which Airflex couplings are particularly adapted are pictured in the folder of The Falk Corp., 3001 West Canal St., Milwaukee, Wis.

CUTTER GRINDER Bulletin No. 54, prepared by The Ingersoll Milling Machine Co., Rockford, Ill., contains 47 pages of photographs, drawings and text arranged to assist the operator in the best methods of grinding. It also contains valuable information on good milling cutter grinding practice.

EXTERNAL COMPARATORS A 19-page booklet illustrating and describing standard, master, gage block and mechanical external comparators, height and snap gages is offered by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn.

GEAR SHAVING "Red Ring Shaving Produces Better Gears Faster" is the title of a 16-page booklet containing information and photographs of gear shaping equipment of the National Broach and Machine Co., 5600 St. Jean, Detroit, Mich.

GRAPHITE Acheson Colloids Corp., Port Huron, Mich., offers a 12-page illustrated bulletin, No. 430-E, on the importance of "dag" colloidal graphite to modern industry.

HEIGHT GAGE A folder giving the outstanding features and picturing the uses of their height gage has been prepared by The H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass.

LATHES An 8-page, file-size catalog, No. 10, illustrating and describing 10-in. toolroom lathes and quick change gear lathes in both floor leg and metal bench models and listing attachments, accessories and tools for use with them.

is offered by South Bend Lathe Works, South Bend, Ind.

LATHES South Bend Lathe Works, South Bend, Ind., offers "The Installation and Leveling of the Lathe," a 20-page bulletin, H-3, covering the many points which must be taken into consideration when installing lathes so that the most efficient operation can be obtained.

LIFTING CLAMPS A folder issued by Merrill Bros., Box 56, Maspeth, N. Y., offers specifications, capacities and price lists covering their line of "Volz" positive plate lifting clamps.

METAL CUTTING The 52-page, vest pocket edition of the tool manual of the McKenna Metals Co., Latrobe, Pa., contains complete information on the care, handling, and most efficient methods of using Kennametal tools.

METAL WASHING Information about the American Tumbl-Spray, Conveyor-Spray and Tabl-Spray metal washing machines is available in illustrated circular No. 9 of American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.

MILLER An 8-page folder, No. 470, containing photographs and text on the No. 3, Model "C" universal bench miller has been published by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.

MILLERS AND GRINDERS A 47-page catalog, No. M-995-1, containing condensed information on their complete line of products, has been issued to the metal working industry by Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio.

MOTORS "How to Get Extra Power Hours in Aircraft Motors" is the title of Bulletin 120 of the Dumore Co., Racine, Wis. This bulletin contains photographs, descriptions, specifications, typical applications, possible modifications and other information on Aeromotors.

NICKEL ALLOYS The International Nickel Co., Inc., 67 Wall St., New York, N. Y., offers a 16-page bulletin entitled "Eight Inco Nickel Alloys for the Process Industries." Data is presented in comparative tables and charts which give "at a glance" information.

NITRIDING Catalog T-624, a 19-page revised edition of its catalog describing the Homo Nitriding Method, is offered by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

PLASTIC PARTS Possibilities of plastic parts in war production applications are illustrated in the folder issued by Creative Plastics Corp., Kent Ave., near DeKalb, Brooklyn, N. Y. The fact that all of their fabrication is

Until Victory is Won

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PRODUCTION SOLDIER . . .

"PRAISE THE LORD AND PASS THE AMMUNITION FASTER"

Wyckoff production soldiers pledge their all-out effort for Victory!

A second star has been added to our distinguished Army-Navy production award!

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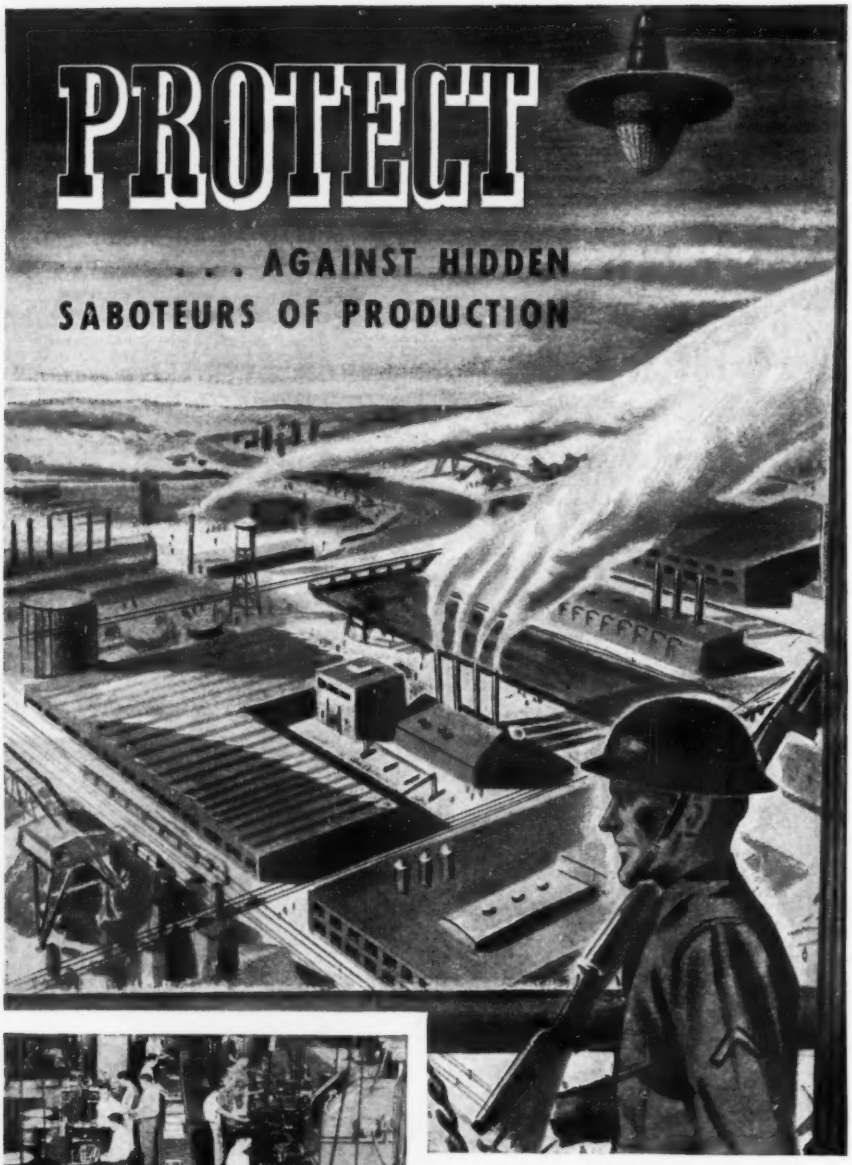

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done without molds and to closest tolerance specifications is emphasized.

PACKING An operating analysis chart with clearly diagramed information for the scientific specification and accurate shop record of hydraulic and pneumatic "U" packings has been issued by Wayne Davies & Co., 325 W. Huron St., Chicago, Ill.

REVOLVING TABLES Both round and square revolving tables are illustrated and described in 12-page bulletin No. 375 of The Ohio Machine Tool Co., Kenton, Ohio.

SPRAY BOOTHS A bulletin introducing the new line of their paint spray booths and dust collection systems is available from Aqua-Restor Division, Mayer Mfg. Corp., 50 Division Place, Brooklyn, N. Y.

SPROCKET WHEELS An 8-page illustrated book, No. 2067, published by Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., lists the sizes of cast tooth sprocket wheels available quickly from stock.

STAINLESS STEELS Oakite Products, Inc., 24 Thames St., New York, N. Y., offers a 3-page Special Service Report entitled "The Fabrication and Surface Treatment of Stainless Steels," in which the machining of stainless steel is discussed.

TRANSFORMER A 12-page bulletin, No. 149, issued by Superior Electric Co., Bristol, Conn., contains information on the Powerstat variable transformer and its many uses.

TURRET MILLS A 12-page bulletin, No. 431, giving the history, inside story, typical operations, specifications and operation charts for "Perfect 36" vertical turret mills, is obtainable from Rogers Machine Works, Inc., 125 Arthur St., Buffalo, N. Y.

TURRET PUNCHES "The Story of Short Run Piercing Economy" is the title of Bulletin No. 92 of Wiedemann Machine Co., 1815-31 Sedgley Ave., Philadelphia, Pa., illustrating and describing turret punch presses with gage tables.

V-BELTING Manheim Mfg. & Belting Co., Manheim, Pa., announces a catalog and instruction manual on Veelos adjustable V-belting, showing in detail the simple steps for coupling and uncoupling the belt.

VISE In addition to specifications and other information on the 3-way angle-set vise, a page of drawings showing typical applications is included in the folder of the Universal Vise & Tool Co., Parma, Mich.

VISES "Modern Machine Vises for Machine Tools" is the title of an 8-page booklet prepared by The Producto Ma-

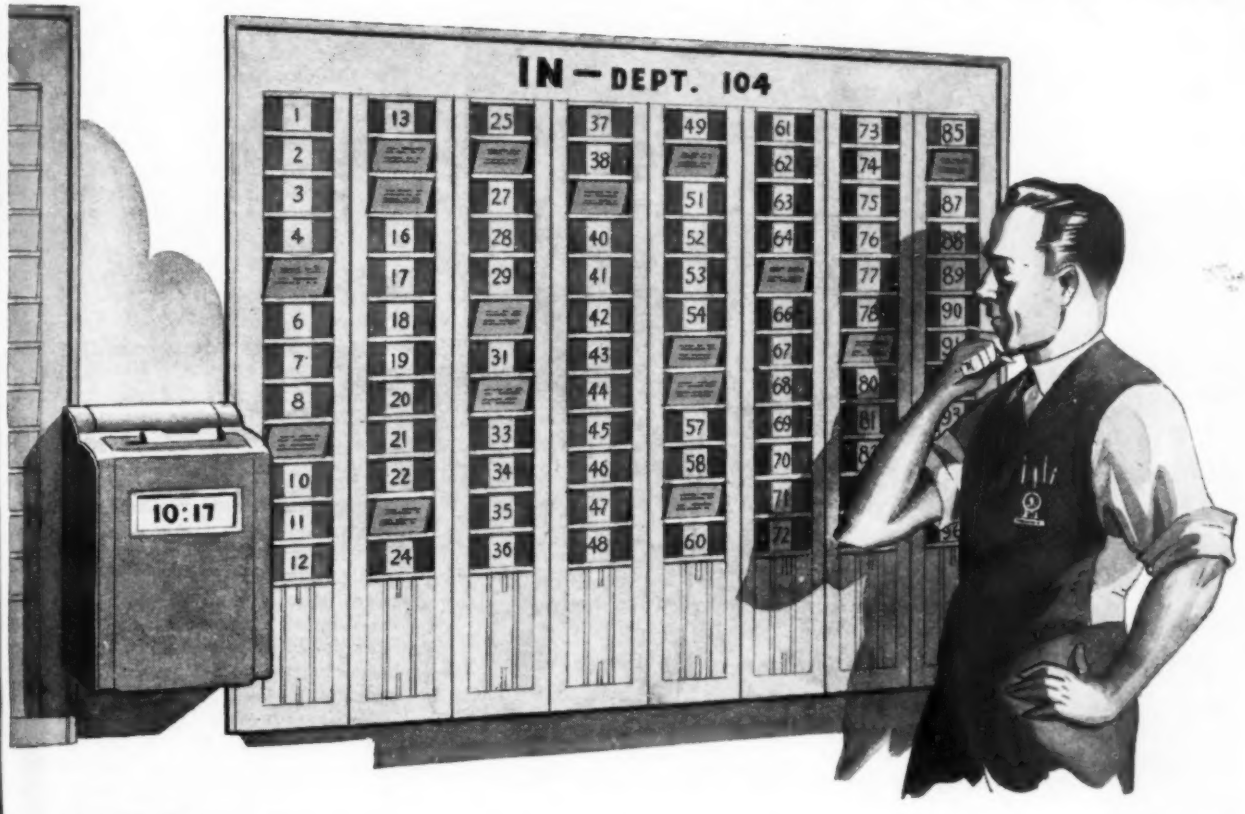
REDUCE ABSENTEEISM

BY USING VICKERS HYDROMOTIVE CONTROLS

Studies of absenteeism have disclosed that fatigue is an important factor . . . particularly with older workers and with women. Machines which require much muscular effort or a series of complex operations for their control tire these workers to the point where they find extra rest necessary.

Machines equipped with Vickers Hydromotive Controls help reduce absenteeism from this cause. Operation of such machines is easy . . . a touch of the finger—a flip of the wrist. Fatigue arising from the need of nervously close attention is eliminated too. Much of the required skill is built into the machine. Complex operations can be reduced to simple routines—or can be made automatic. Controls can be interlocked so it is impossible to do the job wrong. Exact load limitations can be applied so the machine cannot be overloaded.

A Vickers Application Engineer will gladly discuss "hydraulics" in connection with your machines.



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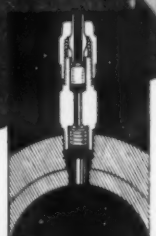

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■ **LUBRICATION CONTROL is of utmost importance in maintaining maximum output. Control must be positive—at all times. With a Bijur lubricator on the job, manpower is concentrated on actual production. The machine practically takes care of itself over long periods of operation.**

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Long Island City **New York**

1916

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chine Co., Bridgeport, Conn. Plain and swivel type vises, the cam lock vise, Quick-Lok vise and Bay State toolroom vise are illustrated and described.

WELDER Bulletin P-50C, published by Pier Equipment Mfg. Co., Benton Harbor, Mich., describes and illustrates P-50 and P-100 Peer air-operated press type combination projection and spot welders.

NEW BOOKS

NATIONAL EMERGENCY STEELS—*Edited by Ernest E. Thum. 72 pages. Published by the American Society for Metals, Cleveland, Ohio. 50 cents.*

Several articles on NE steels which were originally published in *Metal Progress* have been collected by the editor and together with some additional material are now available in booklet form. The booklet describes the various classes of alternate steels, giving their physical properties, hardenability, weldability, and uses. It contains two articles on their use in aircraft manufacture by representatives of the Air Corps at Wright Field. These are from Air Corps Technical Report No. 4799.

•

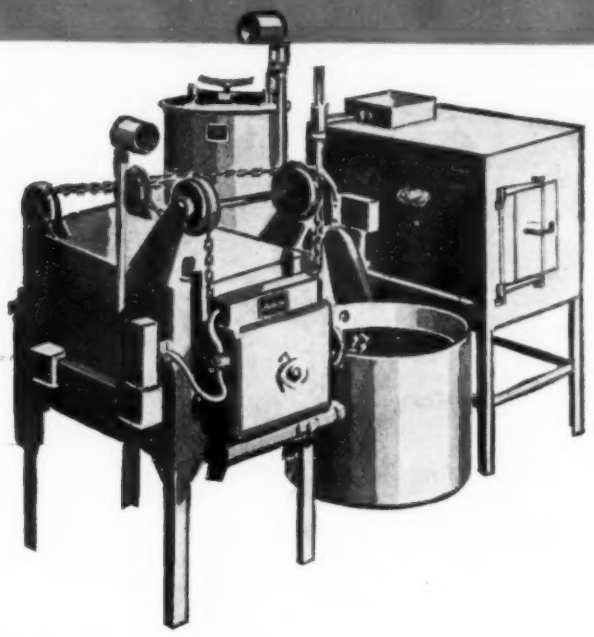
JOB INSTRUCTION—*By Vernon G. Schaefer, assistant professor of psychology, Pennsylvania State College. 316 pages. Published by McGraw-Hill Book Company, New York and London. $2.50.*

This is one of the volumes in the Pennsylvania State College Industrial Series. It is an attempt to outline and discuss the fundamental principles of job instruction in language adapted to the practical situations encountered in teaching adults how to perform industrial jobs. It is intended to help in preparing new job instructors for wartime industrial training programs.

The book is essentially concerned with practical educational psychology. As such, it covers the whole process from teaching the instructor the need for his job, through analyzing and specifying the job, to the actual instruction, and finally to the induction of the new worker.

The bulk of the text treats instruction itself. Each of the following sections receives detailed treatment: Planning the instruction, instruction steps, the demonstration, application and follow-up, practice instruction, starting the new worker right, adjusting and motivating the learner, elements of learning, and measuring accomplishments.

Much of the material is presented in step-by-step outline. Each chapter ends with a number of "Case Problems and Questions." These are presented in the form of a lengthy statement about a particular situation and questions about this situation.



A double play in the toolroom . . .

from HYDRYZING to Quench Tank to CYCLONE!

An unbeatable combination, supplied complete by Lindberg, teams up to give you the most efficient and economical setup for the precision heat treatment of tools and dies.

. . . **from Hydryzing,** the expense of costly cleaning operations is eliminated because the neutral, controlled atmosphere prevents scale, decarb and carburization. The clean surface of the Hydryzed parts assures a full, uniform hardness when the parts are transferred

. . . **to the quench tank,** insuring the maximum life for tools and dies. Incidentally, with toolroom setups, Lindberg can supply quench equipment to meet any specifications, complete with tank, coolers, pumps, storage tanks and temperature controls.

. . . **to the Cyclone** Toolroom Tempering Furnace any tool or die can be entrusted with complete confidence. The parts are heated by 100% forced convection with a uniformity and control accuracy which allows temper tolerances of ± 1 Rockwell "C."

Thus is precision heat treating accomplished—Hydryzing insures the time and money put into the machining of the tool or die and the Cyclone puts it into long, productive service with the specified toughness to carry through.

You can have all the advantages of a winning team—write TODAY for Bulletin 94 on Hydryzing and Bulletin 62 on the Cyclone Toolroom Tempering Furnace.

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LINDBERG FURNACES

ARMY (E) NAVY

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

Gulf Service Engineers are helping war industry make better weapons, faster!

Artillery Recoil Cylinders . . . By following the recommendations of a Gulf Lubrication Service Engineer, a large ordnance plant increased production 30% and increased tool life 300% in machining operations on hardened nickel chrome steel forgings for artillery recoil cylinders.

★

37 Mm. Shot . . . A manufacturer of 37 mm. shot substantially increased production per tool regrind by using Gulf Electro Cutting Oil and correcting the rake angle on the cutting tool —as recommended by a Gulf Lubrication Service Engineer.

★

75 Mm. Shells . . . 75 mm. high explosive shells came off the finishing line coated with rust in a large ordnance plant until the practical recommendations of a Gulf Lubrication Service Engineer were adopted. It was formerly necessary to clean the shells carefully by hand, which caused a serious production bottleneck. Adoption of Gulf Engineering recommendations entirely cleared up the difficulty and substantially increased production.

★

Armor Plate for Bombers . . . By using Gulf L. S. Cutting Base A, as recommended by a Gulf Lubrication Service Engineer, an airplane manufacturer obtained a large increase in production per tool grind and generally improved finish in machining and drilling armor plate for Army dive bombers.

Bomb Striker Nuts . . . Consulted by a manufacturer of steel striker nuts for bombs on the problem of 100% rejection of production due to torn threads in a tapping operation, a Gulf Lubrication Service Engineer recommended Gulf Lasupar Cutting Oil A and a suitable level on the end of the tap. Result: rejections entirely eliminated, production greatly increased.

★

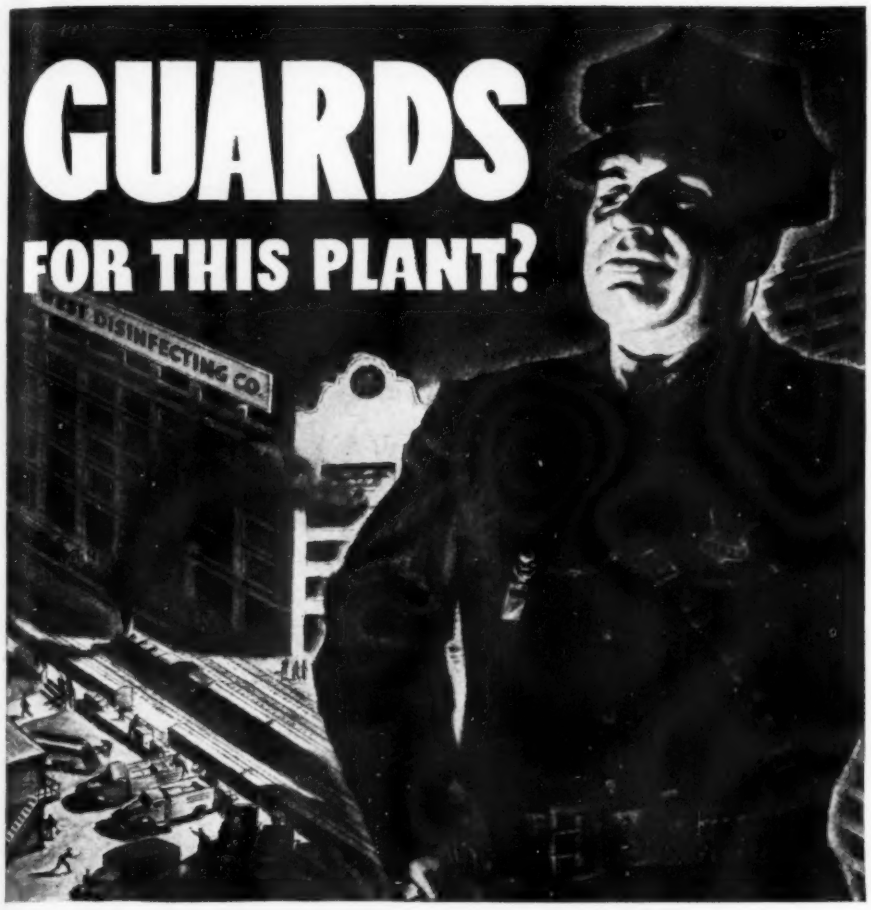
Primer Holders . . . Consulted on the problem of chatter marks on the threads of primer holders for 155 mm. firing mechanisms, a Gulf Lubrication Service Engineer recommended Gulf Cutx B and a change in the rake angle of the cutting tool. Result: rejections for chatter marks entirely eliminated.

GULF OIL CORPORATION · GULF REFINING COMPANY · PITTSBURGH, PA.

★ ★ ★

Call in a Gulf Lubrication Service Engineer to help step up your production

GULF INDUSTRIAL LUBRICATION



CERTAINLY...*It Helps Protect America's Essential Weapons!*

The men and women in our war plants are America's most essential weapons. They *must* be kept on the job. The U. S. Public Health Service estimates that 65% of all occupational diseases have been industrial dermatosis. Three *proven* products are recommended to help combat this threat and promote healthier and more productive hands.

LAN-O-KLEEN* for washing hands is a basic start—a powdered soap of proven value in helping to prevent dermatitis in war plants from coast to coast. It is a powdered soap of *mildly* alkaline reaction compounded with granular corn-meal which has been impregnated (by our exclusive process) with lanolin, an oil almost identical to the natural oils secreted by the glands of the skin. Lanolin helps nature to maintain a normal, healthy skin condition.

WESCOL* a special high power disinfectant in your cutting-oils helps prevent oil-dermatitis, otherwise easily spread from one worker to another in the recirculation of your cutting-oils and cooling compounds that may contain harmful bacteria.

WEST PROTECTIVE CREAMS act as an external protection when rubbed on the exposed skin. These creams help guard the workers from most of the wide variety of skin irritants which may lead to dermatitis. A West specialist will help you determine which of the many West Protective Creams are best suited to protect the workers against the specific irritants handled in your industry.

*Trade Mark Reg. U. S. Pat. Off.

55 BRANCHES • HELPING TO GUARD INDUSTRIAL HEALTH • COAST TO COAST

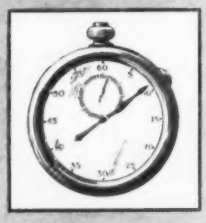
WEST DISINFECTING Company

42-16 WEST STREET • LONG ISLAND CITY • N. Y.

CLIP TO YOUR BUSINESS LETTERHEAD, PLEASE

West Disinfecting Company, Dept. AM., 42-16 West St., L. I. C., N.Y.
Please send me literature on
Lan-O-Kleen ☐ Wescol ☐ West Protective Creams ☐
also sample of Lan-O-Kleen ☐

Name..... Title.....



FASTER CUTTING

— The better cooling and lubricating job performed by Tycol Transparent Sulphurized Cutting Oil is effecting material savings in time and enables greater output even on the toughest of steels.

FINER FINISHES

— Tide Water Transparent Cutting Oil is unique among sulphur base cutting oils in that it does not tarnish the work. This important consideration led thousands of machine tool users to insist on Tycol.

LONGER TOOL LIFE

— Tools that work under Tycol Cutting Oil have a long useful life. Regrindings are cut materially and the problem of chips welding to the tool is minimized.

with TYCOL Cutting Oils

1,181% increase...

in taps per grind with TYCOL SOLUBLE OIL!

26,250 nuts sound like a lot of nuts, but 310,000 are over 11 times as many. And that's the difference in nut production, between tap grindings, Tycol 678 Sulphurized Soluble Oil achieved for one large manufacturer.

In identical machines, each flushed and equipped with new taps, one was replenished with Tycol 678, the other with a similarly priced oil, both in charge of one operator. During the first 21 working days the tap used with oil of equal price was ground 8 times, tapping 26,250 nuts per grind, and was worn out. The tap used with Tycol 678 was ground for the first time after 31 working days (10 days after its contemporary had failed completely), during which 310,000 nuts were tapped. Presumably the life of this tap will also be 8 grindings, during which it will have *tapped 2,480,000 nuts as compared with 210,000 for its teammate.*

This is not an isolated example. Reports roll in continually about more and better shell, bomb, gun barrel, and similar war production increases with Tycol Cutting Oils throughout the land. Let Tycol help increase and improve production and save man hours and tools for you. Call a Tide Water Engineer today for recommendations calculated to get maximum efficiency in each of your machining operations.

Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.
TIDE WATER OIL COMPANY OF CANADA, LTD. • Toronto — Montreal

TIDE WATER ASSOCIATED OIL COMPANY

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL • EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK

OIL IS AMMUNITION
USE IT WISELY!

DRUMS! DRUMS! DRUMS!

War needs make it extremely important that all empty drums be returned immediately

THE SAME METHODS WILL WIN YOUR POST-WAR BATTLES

Since welding is taking such a big hand in winning the war, why shouldn't I watch it closely for ideas to win my battles for business after the war?

ALTER EGO: That's logical. Where you see welding, you see faster production and far better ships, planes, tanks and guns. The same basic methods can be used after the war to cut costs and build better autos, machines, appliances and buildings.

Can I get any ideas from the wartime gasoline tanks they're welding here?

ALTER EGO: Sure! In the first place, they're welded. And they're welded fast. Ever hear of welding 10 to 14-gauge sheet with $\frac{3}{16}''$ electrode? Usual practice requires $\frac{1}{8}''$ or $\frac{5}{32}''$ size. This shop developed fit-up jigs and positioning fixtures to allow the $\frac{3}{16}''$ size. *This bigger electrode saves them 33% in man-hours.*

Then, the big problem is not only to find ways to apply welding to my post-war products, but to find ways to beat competition on the cost of my welding.

ALTER EGO: You're right. You should use this double approach to post-war profits by keeping an eye on the big war-job welding is doing . . and by all means, ask for Lincoln cooperation on design and production.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

THERE'S ALWAYS SOMETHING NEW UNDER THE ARC

SALEM GAVE US A SURE-FIRE METHOD OF ANNEALING ALUMINUM . . .

Ingenuity Again Speeds War Production

So, instead of using off-the-shelf drawings, Salem Engineers design and build SPECIAL aluminum annealing furnaces to meet individual requirements. Sure enough, they use proven methods that are the products of broad experience...but Salem Engineers use ingenuity, too. For example—in the furnace pictured above, a unique method of convection heating is applied to a furnace in which the dolly method is incorporated for handling aluminum plates and sheets. Among other things, Salem's "KNOW HOW" provides the proper ratio between radiation and circulation which permits the most accurate, uniform, and dependable production—no re-melting, no re-treating. Here is not an ordinary low temperature oven, but rather a sturdy HEAT TREATING FURNACE that couples big production with accuracy—low heating costs with low maintenance expense. Write today.

SALEM ENGINEERING COMPANY

SALEM ENGINEERING CO. · SALEM, OHIO

Small Tool Shortage *EXTREMELY CRITICAL*

MORE PRODUCTION* WITH LESS TOOLS**

Through

McCASKEY TOOL CRIB CONTROL...

★LOST MINUTES TURNED INTO PRODUCTIVE HOURS

The line of two or three or more employees waiting at the crib window to draw and return tools represents a loss of production that is entirely unnecessary. McCaskey Control enables attendants—even the inexperienced ones in so many plants today—to locate tools without delay whether in the crib or out on the production floor, to record each transaction and to quickly serve everyone without a single dispute concerning responsibility for tools loaned or returned.

The works accountant of a large manufacturer of war products says: "A big reduction in the number of tool crib clerks required and an even larger saving in time of machine operators procuring tools has resulted. The McCaskey Control superseded the brass check method prevalent in former days."

Numerous time studies made by users have shown that the average transaction with McCaskey takes only half the time with checks and other systems. (Examples on request.) The result is less idle time for men and machines—more production for both.

★★"LOST" TOOLS LOCATED WITHOUT DELAY

McCaskey Control prevents employees from hoarding tools that should be in the crib available for use. Many "lost" tools simply are out-of-sight in some employee's tool box or at his machine. McCaskey fixes responsibility for each tool loaned to each employee, showing how many each has and how long each tool has been out. Tools are kept in circulation and inventories are reduced. Loss and theft are eliminated and breakage invariably is cut twenty-five to fifty percent.

Investigate these and numerous other savings made through McCaskey for a surprisingly low investment. Qualified industrial representatives are available to analyze your requirements and offer practical recommendations. No obligation. Write today.

From the Master Mechanic of a leading Rochester, N. Y., manufacturer: "In January, 1938, we replaced our old tool check system with McCaskey Tool Control. The loss of tools stopped immediately and so did all disputes about getting back the same tool loaned to employees. These and other savings have resulted in reduced tool costs."

Let us have a representative explain how McCaskey Tool Control can be installed in the busiest cribs without disturbing production in the least—or send you factual reports on McCaskey savings in time and tools in several well-known plants.

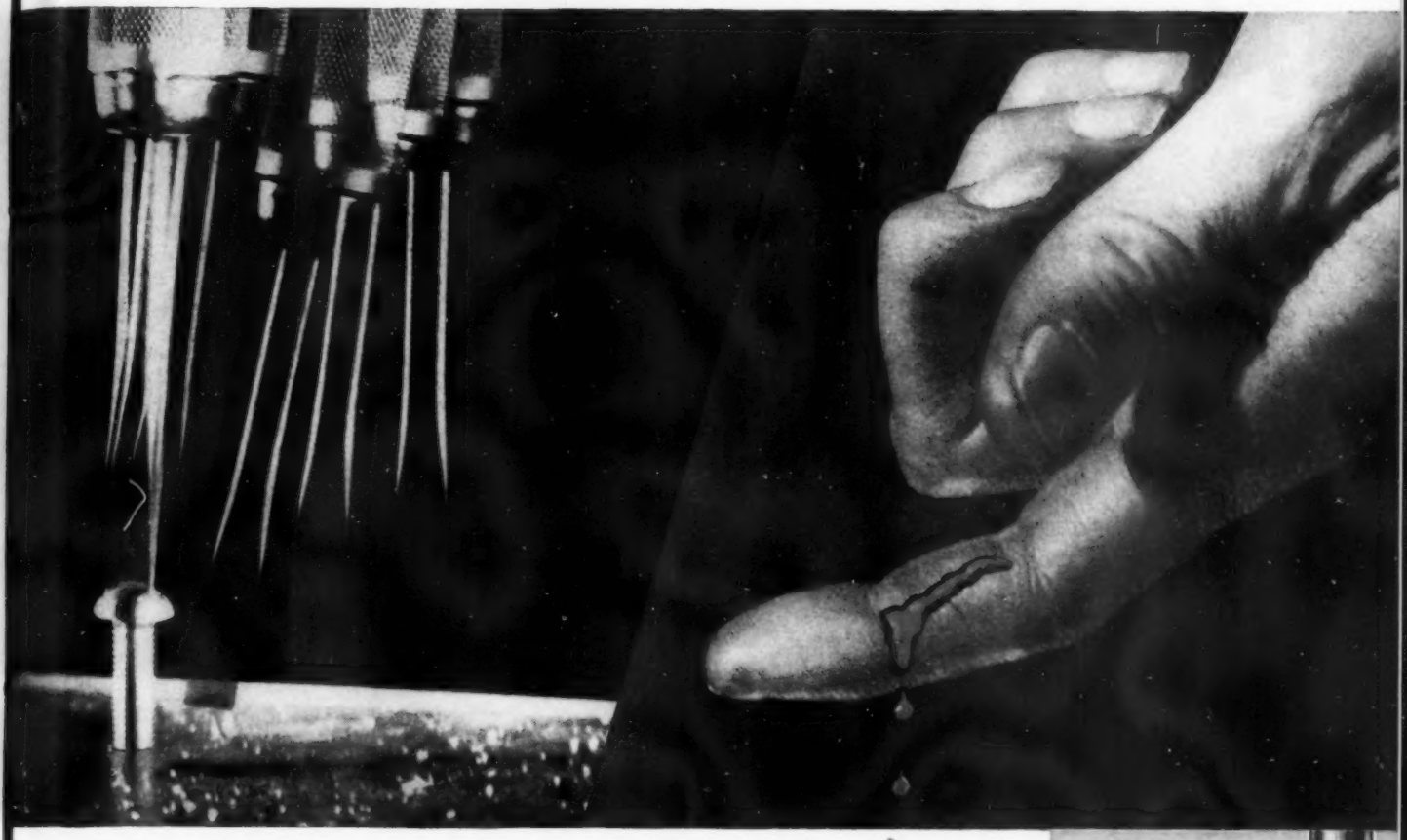
McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

How to PREVENT THIS SABOTAGE to Your Screw Driving Army



PHILLIPS SCREWS END DRIVER-SKIDS!

Caught in the act by the "frozen" action photography* of Gjon Mili, is a skidding screw driver . . . one of the meanest of saboteurs. Skidding drivers cause accidents that keep all too many workers away from assembly lines, nursing gouged hands. And, fear of such injury slows-down the work of countless others. Always present, the danger increases with rushed, inexperienced workers. So, it's doubly important today to specify Phillips Recessed Head Screws . . . which prevent driver-skids!

Automatic centering of driving force in the scientifically designed Phillips Recess eliminates all other screw driving troubles: the fumbling, wobbly starts . . . re-driving of slant-driven screws . . . removal of broken-head screws . . . reclaiming of marred parts. Fast, faultless driving becomes automatic, even for "green hands" Power driving becomes practical.

They cost less to use! Compare *driving* costs. You'll find that screw *price* is a minor part of total fastening expense . . . that it actually costs less to have the advantages of the Phillips Recess.

**Gjon Mili synchronizes exposures with lightning-like flashes of the stroboscopic light, to make skidding driver appear to stand still.*

PHILLIPS *Recessed Head* SCREWS

KEY TO FASTENING SPEED AND SAFETY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOL

21 SOURCES

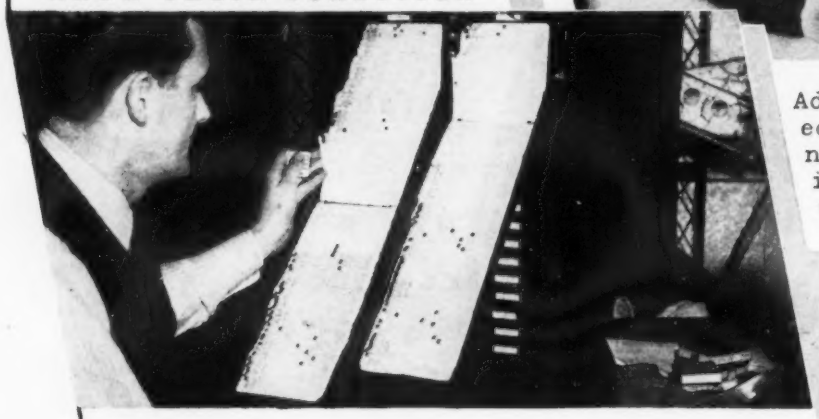
American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

FOR *Best* *Results* FROM GAGES

TEST THEM FREQUENTLY

Adequate checking and measuring equipment, with provision for needed repairs and adjustments, is indispensable to proper maintenance of your gaging system.

KNOW THEIR CONDITION

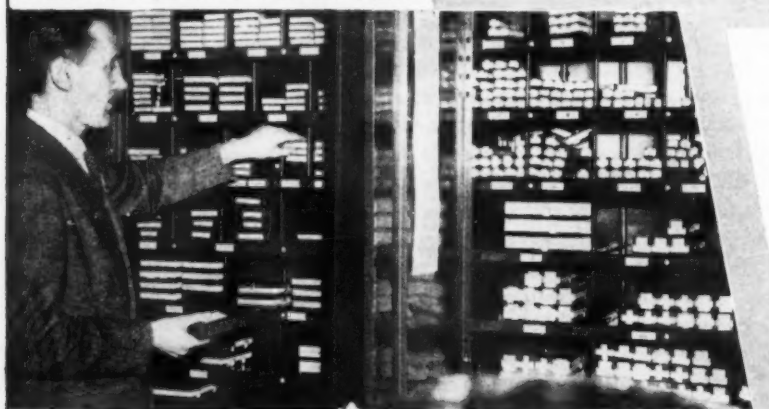


An adequate accounting system indicates exactly the present condition of your gages, shows when they were last checked, warns when new gages should be ordered.

Photos courtesy Republic Aviation Corp.

Just what gaging system you should have depends upon the set-up of your own plant. But the experience of many plants shows the value of due regard to the three features illustrated on this page.

PROTECT THEM BETWEEN JOBS



Determine the method best adapted to your plant which assures safe storage for gages while not at work. In the tool crib shown here, gages are replaced, and sealed in their original packages, after each job.

Adequate testing of gages, safe and convenient storage, and accurate records of their use and condition — these are the three essentials to keep in mind. Planning for these with care will pay you well in better size control of your product.

• • •

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
DETROIT PLANT 5850 Second Boulevard
WAREHOUSES in
New York, Chicago and Los Angeles
In Canada GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

GTD GREENFIELD
TAPS • DIES • GAGES • TWIST DRILLS • SCREW PLATES

Tool Conservation Begins in the Tool Crib

VICTORY COBALT

This new Class A High Speed Steel is the answer to the demand for increased cutting service on heat treated steels as well as cast iron.

Victory Cobalt serves the war effort by combining unusual cutting ability and long wear with the conservation of strategic alloys.

Vanadium-Alloys

STEEL CO. LATROBE, PA.

CHECK THE FEATURES YOU WANT IN A WORK-BENCH ...YOU'LL FIND THEM ALL IN HALLOWELL SHOP EQUIPMENT

RIGHT SIZE

"Hallowell" ready-made Work-Benches are made in five heights and widths and in seven standard lengths from 3 to 10 feet. Any number can be joined end to end for a continuous work-bench. 1367 combinations available.

CONVENIENCE

Pilfer-proof drawer units, shelves, cabinets, etc., are available to make the benches fit the job. Prices and deliveries are right.

STURDY CONSTRUCTION

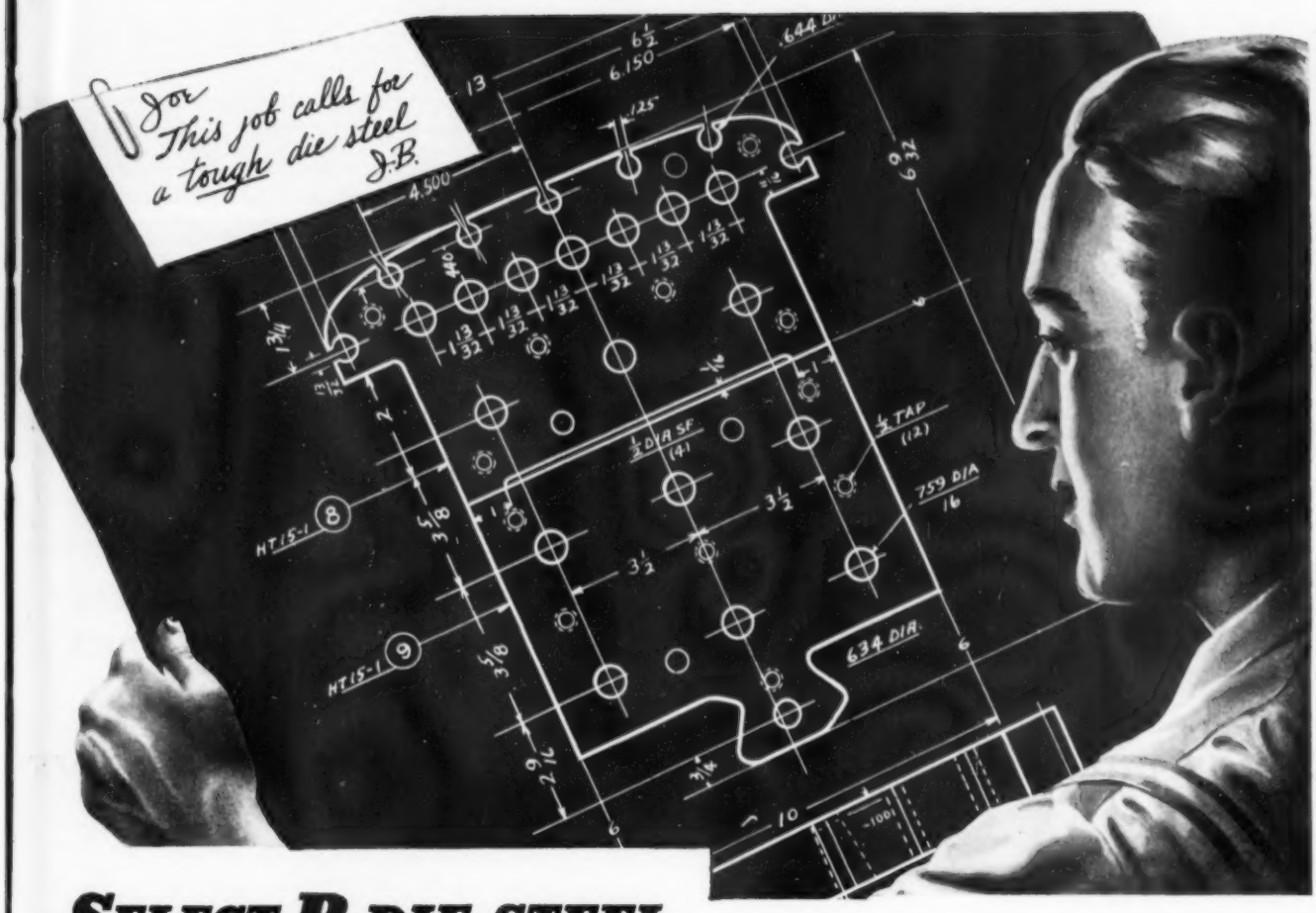
Constructed for long wear and made to stand firm and rigid without costly, time taking bolting to the floor.

STANDARD PRESSED STEEL CO.

BOX 4, JENKINTOWN, PA.

BRANCHES

BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO



SELECT B DIE STEEL
...for toughness

"My problem is simply this: I have to choose a die steel that is tough and yet withstands considerable abrasion." So said a perplexed die shop superintendent recently to our metallurgical service man. "And don't forget," he added, "it has to machine easily, must be non-deforming and can't be ground after hardening — so the die must be free from scale or decarburization after heat treatment."

"Well, here is the answer," said the Latrobe Metallurgical Service Man. "It's *Select B* . . . a tough die steel that won't deform and will withstand abrasion. As far as heat treating, that is easy: Pack the die in sifted grey cast iron chips, dry charcoal or spent carburizing compound. Cast iron chips will prove preferable, since they won't build up carbon and cause brittleness of cutting edges.

"Since the dies are of a rather intricate nature, preheat at about 1400°F. As soon as they have become heated to this temperature bring furnace up to 1750–1775°F. Hold for just sufficient time for the container to become thoroughly heated, then remove the part and air cool in still air.

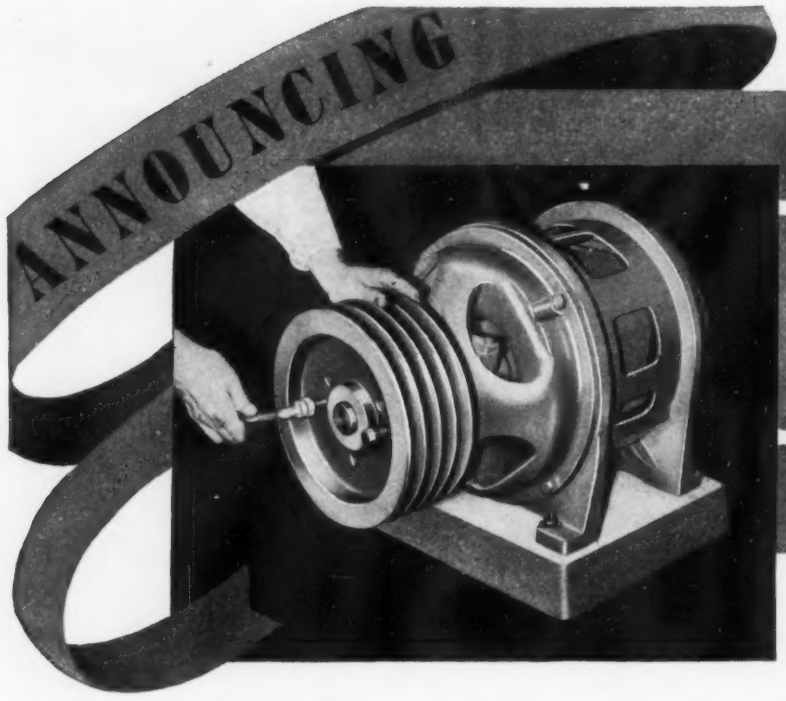
"When you can just about pick the dies up with your bare hand draw them at 900°F. The thickness being about 2½", hold for about four hours at this temperature. This will give a hardness of about Rockwell C-58 with the necessary toughness."

The result: This Company greatly simplified their die machinery problems, the production was increased and a substantial saving in their die steel costs was secured. It's a simple illustration of the timely help you can get to meet today's vital production problems with Latrobe Metallurgical Service. It's a technical help you can feel free to use. A special bulletin on "Select B" is available.

LESCO

TOOL STEELS FOR VICTORY

LATROBE
ELECTRIC STEEL COMPANY
MAIN OFFICES *and* PLANT • • • LATROBE • PA •



PYOTT

QUICK DETACHABLE QD

SHEAVES

STANDARDIZED "Q-D SIZES"
AT NO INCREASE IN PRICE

Save Time and Labor for Machinery Manufacturers

QUICK AND EASY TO INSTALL—OR REMOVE

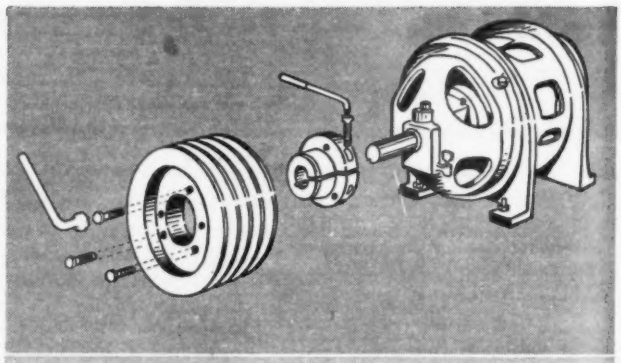
...in minutes, instead of hours!

NOW, machinery manufacturers can enjoy the many advantages of Q-D Sheaves and add sales appeal to their product without increasing their costs—in fact, in many instances, effect substantial savings.

The speed with which Pyott Q-D Sheaves can be assembled for test runs—and disassembled for shipment is of tremendous importance. And, as the hub may be left on the shaft, the user is assured of an accurate pre-aligned V-Drive.

Other advantages from the user's standpoint include: a positive fit on shaft; no weave or wobble; quick changes of sheaves for seasonal needs for different speeds without requiring a variable speed motor; no battered motor bearings or damaged sheaves as the result of mounting or dismounting operations.

No change in engineering is necessary to switch from standard sheaves and bushings to Pyott Q-D Sheaves—and you pay no premium for standardized "Q-D sizes."



Simple as A-B-C

A Slip split hub on shaft in line with keyway. Tighten clamping cap screw which anchors hub immovably to shaft.

B Slip sheave on tapered hub in line with bolt holes. Insert pull-up bolts and tighten, which provides a tapered friction drive assembly and a positive press fit on shaft.

C To remove, unscrew pull-up bolts and insert two in tapped holes in rim of sheave. Turn down and the bolts pressing against hub act as jack screws, loosen the sheave until it can be slipped off.

PYOTT

FOUNDRY & MACHINE CO.
328 North Sangamon Street, Chicago, Illinois

SPROCKETS, GEARS, PULLEYS, SHEAVES
CAST IRON AND SEMI-STEEL FOUNDRY WORK

88 MINUTE GRINDING JOB SHORTENED TO 44...WITH MARATHON C-6 CUTTING OIL

- **C-6 actually stepped up work speed from 2 to 4 R.P.M. in test in leading airplane parts plant.**
- **Cut down dressings required from 16 to 4.**
- **Marathon C-6 Grinding Oil is increasing output of men and machines in more and more war-busy plants throughout the country.**

This is not an isolated case. It is a typical performance—of the kind that is being experienced in more and more plants *when Marathon C-6 Grinding Oil goes on the job.*

Why not demonstrate what Marathon C-6 Grinding Oil can do *for you*—in *your own* plant? See for yourself how clean it is, how it keeps machines from gumming up . . . how it operates at lower temperatures, resulting in greater accuracy, less spoilage, longer wheel life.

Phone, wire or write, today. Ask an Ohio Oil Lubrication Engineer to call with the facts.

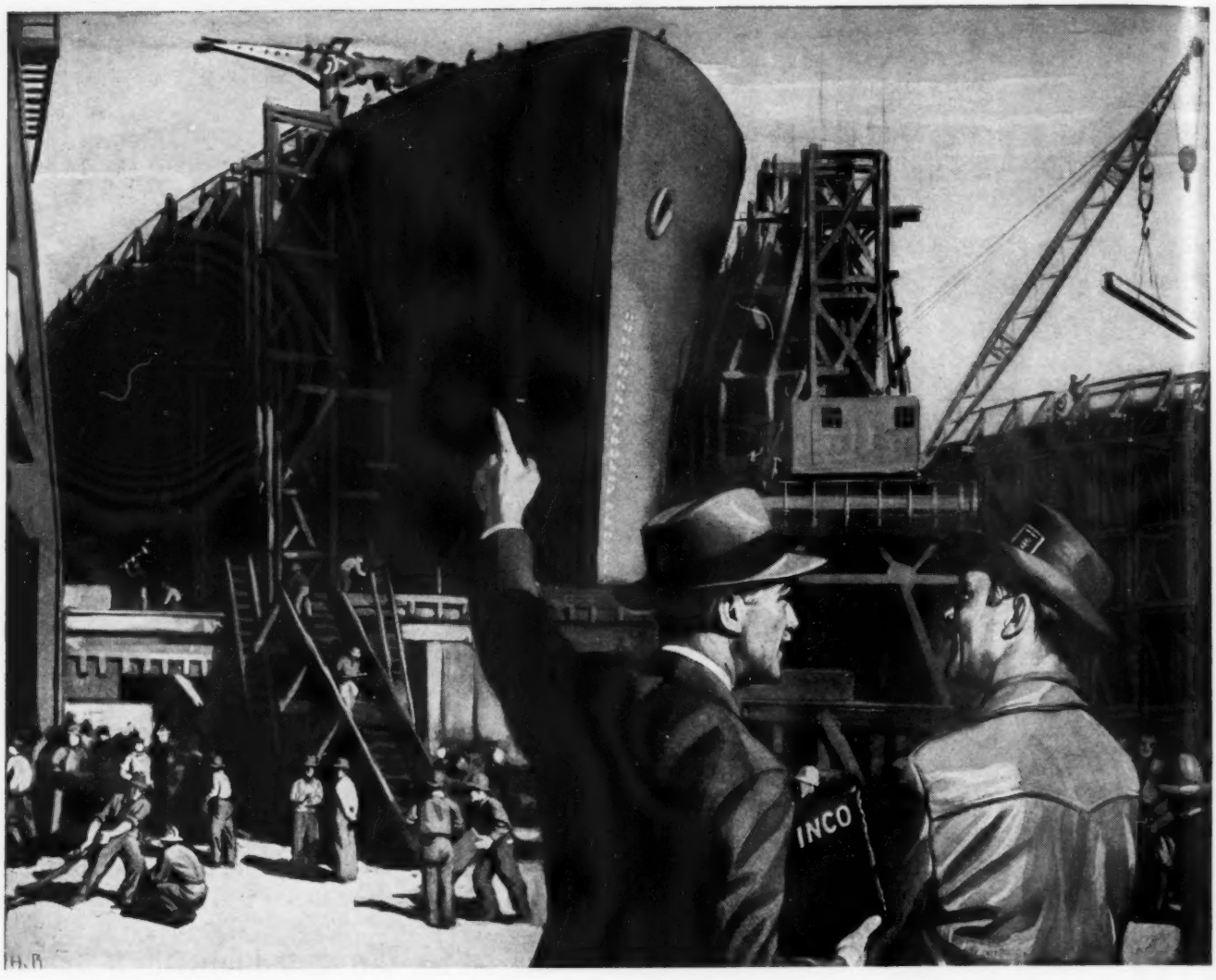
The Outstanding General Purpose Cutting Oil for Boring, Turning, Broaching—and diluted for gear grinding, thread cutting and milling.

THE OHIO OIL CO.

General Offices, Findlay, Ohio • District Offices: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

MARATHON

PRODUCERS OF PETROLEUM SINCE 1887



NICKEL AIDS THE MARINE INDUSTRY

to KEEP 'EM SAILING!

"Uncle *Needs* His Ships." That sign in a shipyard, a thousand miles from the sea, typifies the fighting spirit of America's ship builders. These men will turn out new tonnage faster than Axis bombs and torpedoes can sink it.

In peacetime, their engineering-thinking created efficient power plants that pushed ships of commerce through the seven seas. They designed propelling machinery—turbines, valves, pumps and gears—to move the ship and intricate instruments to guide and guard it on its important mission.

From turbine rotors to propeller shafts, from reduction gears to condenser tubes, those engineers relied upon ferrous and non-ferrous alloys strengthened and toughened by additions of Nickel. They used the properties of Nickel to fight corrosion and fatigue.

During wartime, when uninterrupted operation of America's bridge of ships means so much, the continued and widespread use of Nickel is convincing evidence of its many advantages. Now that sea-going metals must withstand repeated demands for stepped-up performance, a little Nickel goes a long way to insure utmost dependability.

Marine engineers and designers have long known and builders and fitters... as well as repair crews at bases 'round the globe... are learning that, properly used, a little Nickel goes a long way to "keep 'em sailing."

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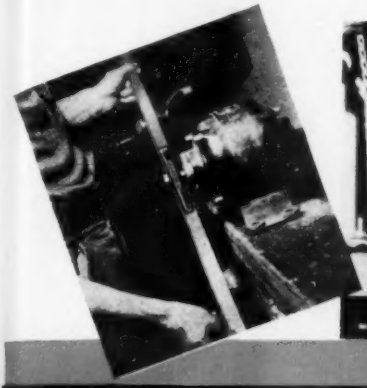

Part clamped in press being finished by contact with Brightboy Hand Tablet on press table.

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PROVERBIALLY, just one straw too many breaks a camel's back.

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And it may be some production man, some engineer, some plant executive . . . it may be you . . . that will speed the production of the "straw" . . . the shell, plane, bomb or tank that will win this war.

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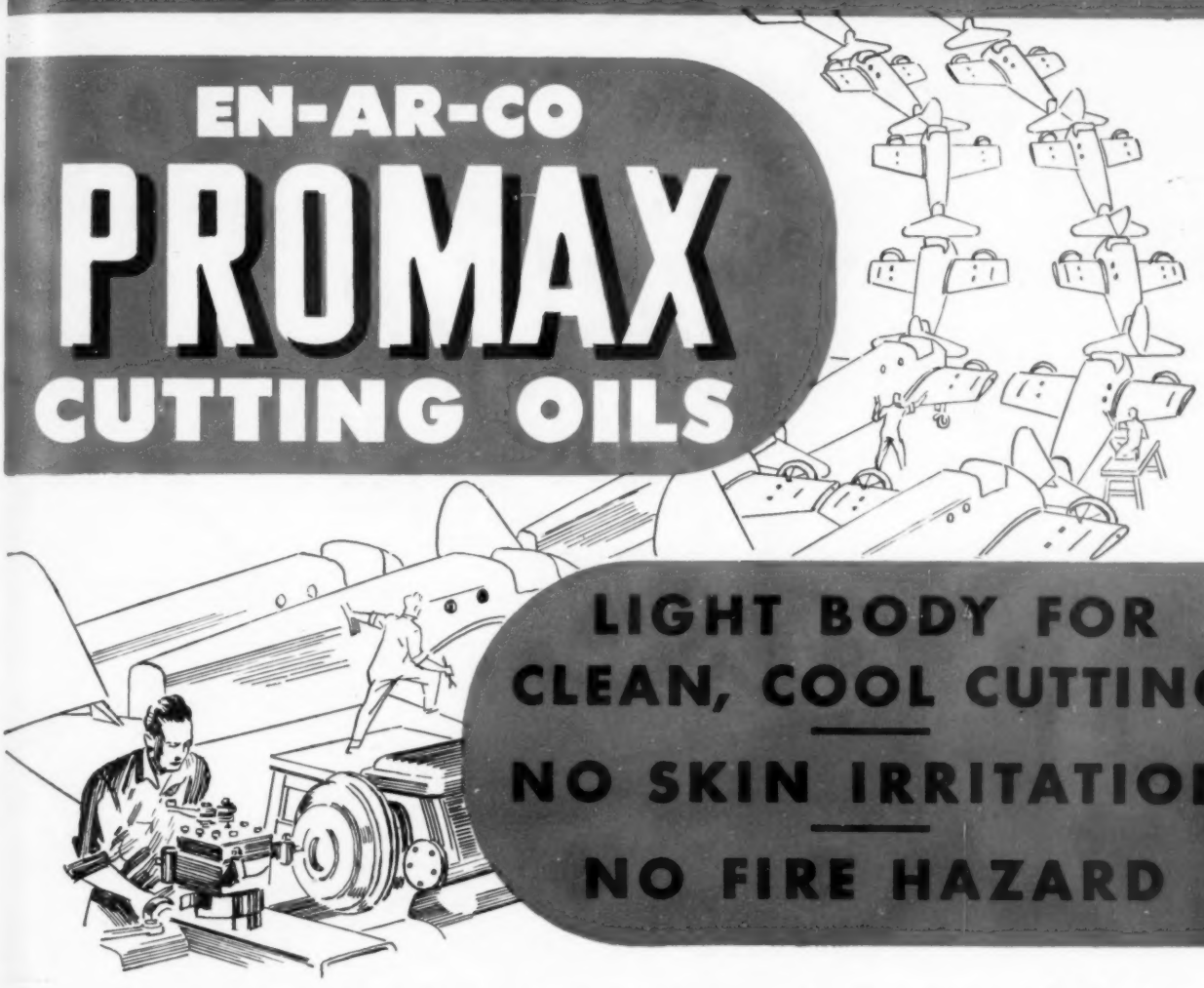

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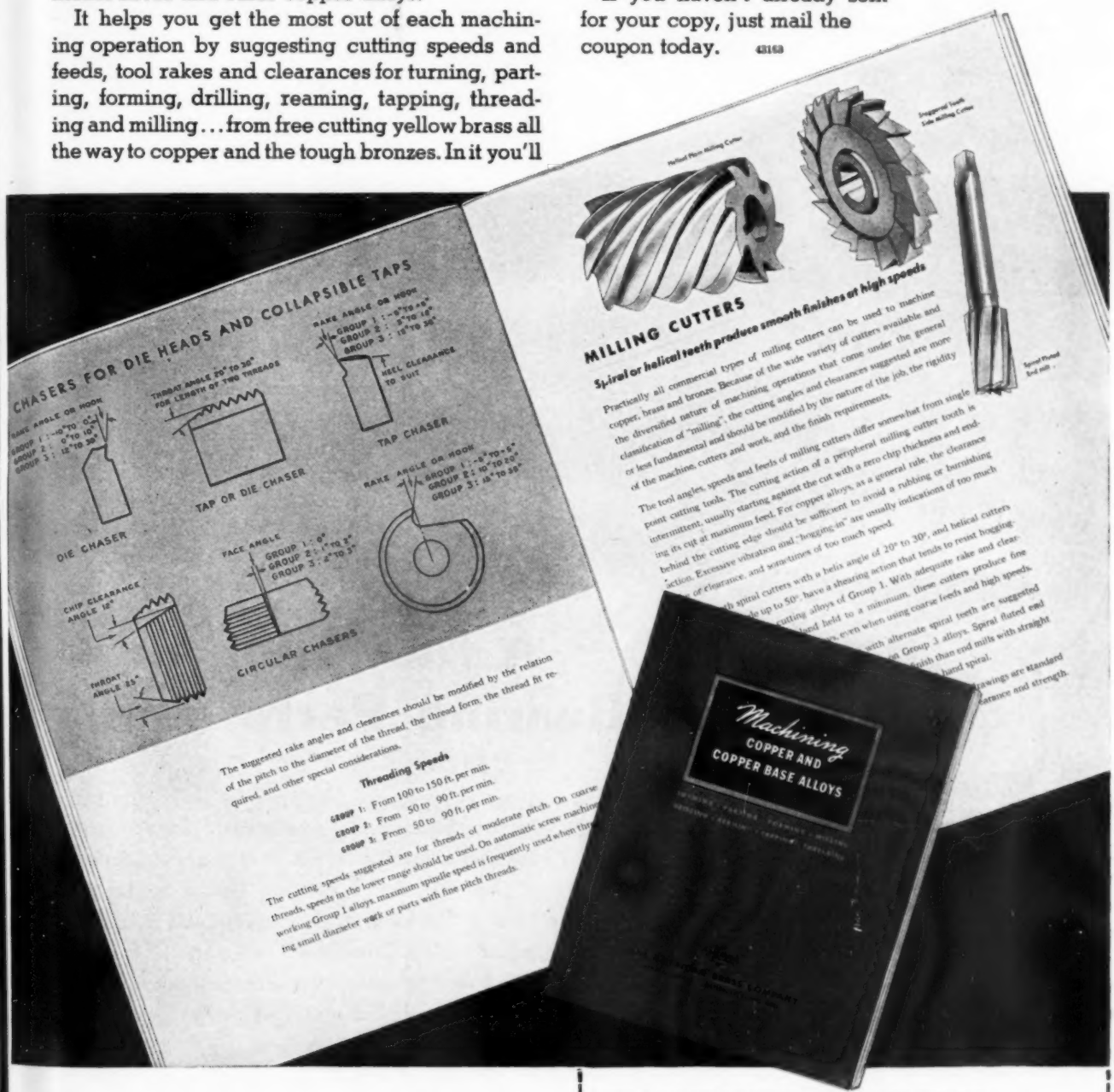

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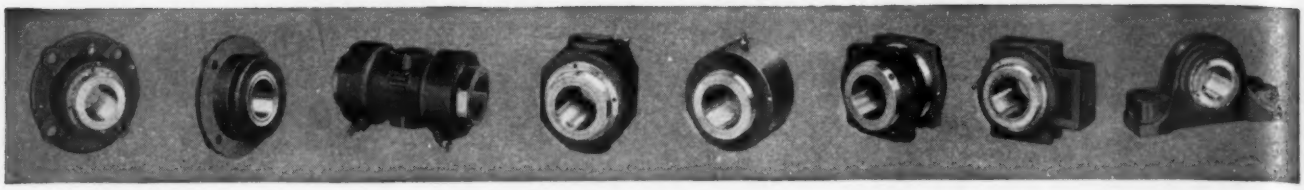

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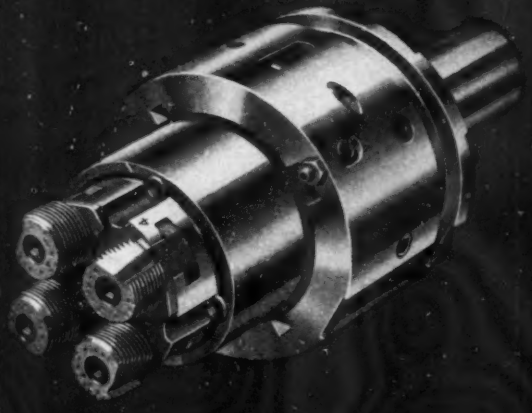

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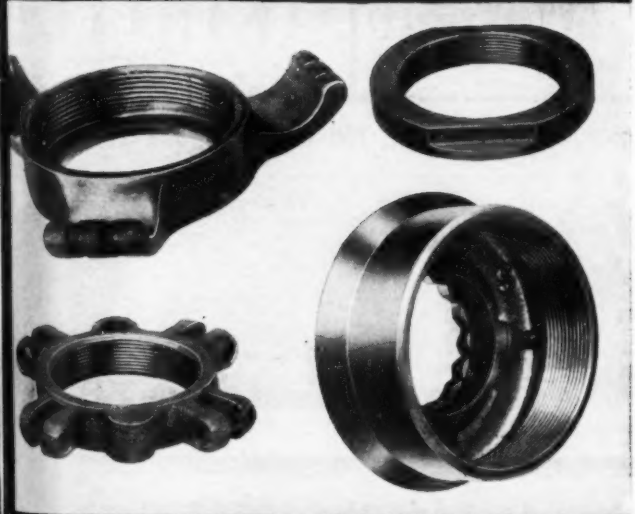

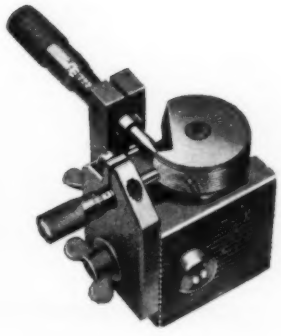

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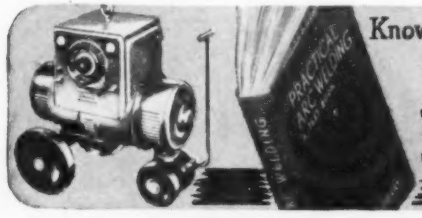

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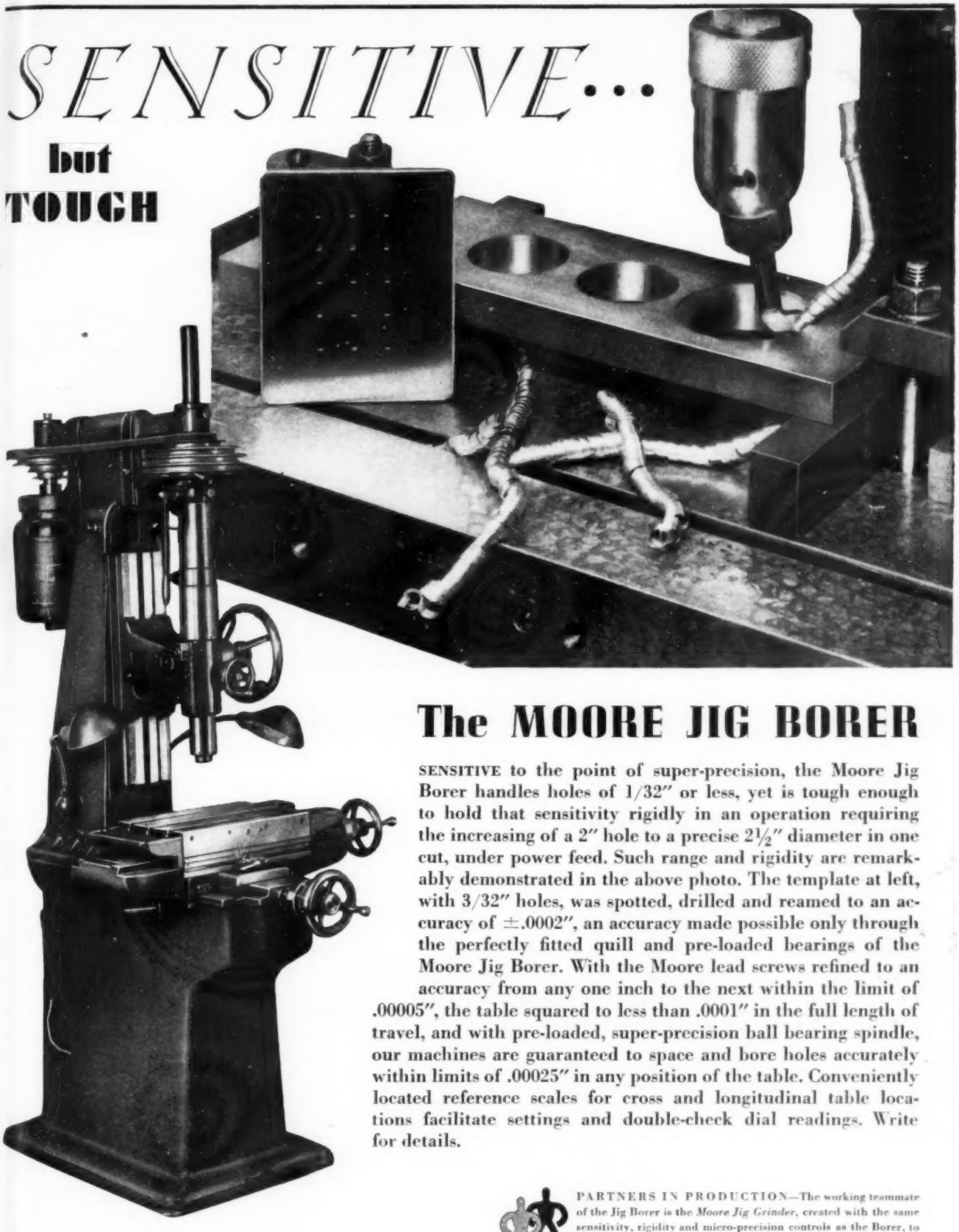

The MOORE JIG BORER

SENSITIVE to the point of super-precision, the Moore Jig Borer handles holes of 1/32″ or less, yet is tough enough to hold that sensitivity rigidly in an operation requiring the increasing of a 2″ hole to a precise 2½″ diameter in one cut, under power feed. Such range and rigidity are remarkably demonstrated in the above photo. The template at left, with 3/32″ holes, was spotted, drilled and reamed to an accuracy of ±.0002″, an accuracy made possible only through the perfectly fitted quill and pre-loaded bearings of the Moore Jig Borer. With the Moore lead screws refined to an accuracy from any one inch to the next within the limit of .00005″, the table squared to less than .0001″ in the full length of travel, and with pre-loaded, super-precision ball bearing spindle, our machines are guaranteed to space and bore holes accurately within limits of .00025″ in any position of the table. Conveniently located reference scales for cross and longitudinal table locations facilitate settings and double-check dial readings. Write for details.

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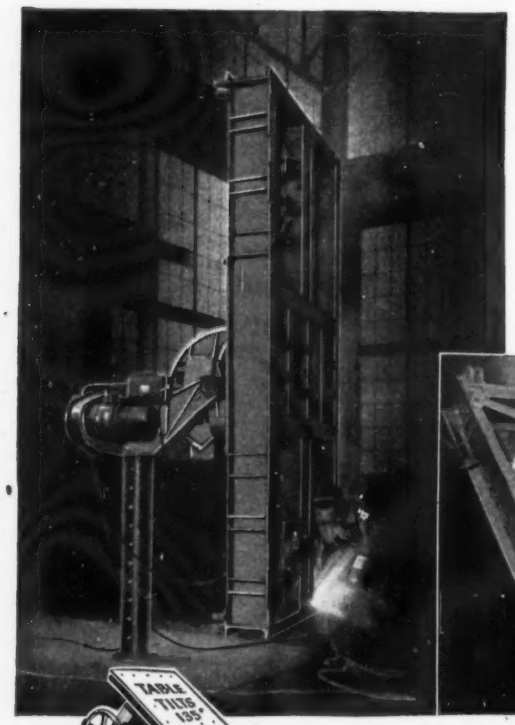

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C-F POSITIONERS are changing fabricating methods on many products . . . have made it faster and cheaper to *weld* them by eliminating handling problems, greatly increasing output and permitting all welds to be made strong, smooth and flawless.

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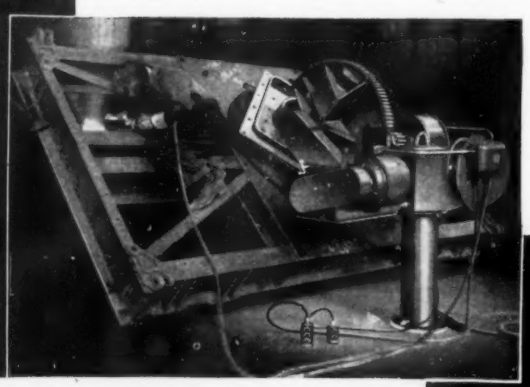

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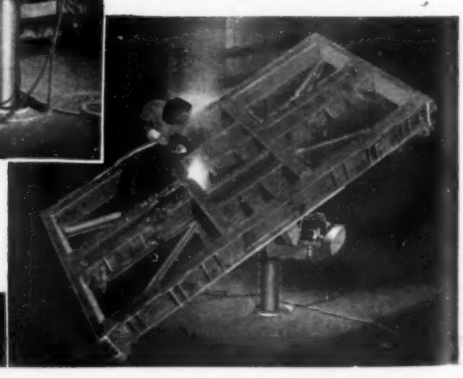

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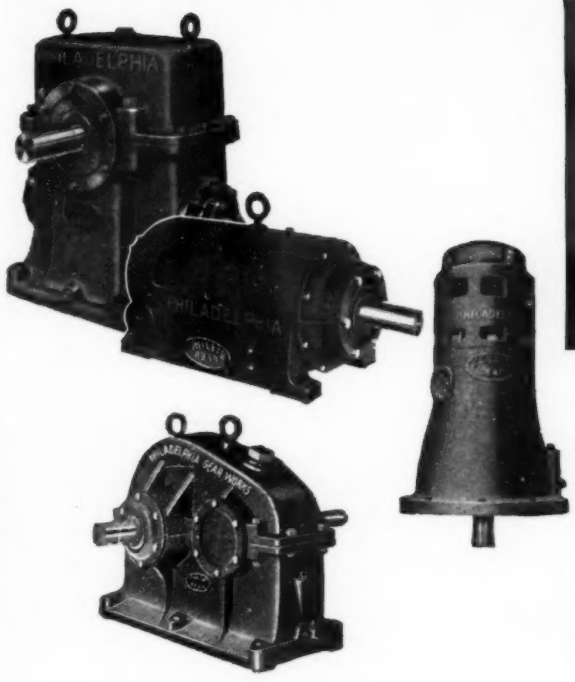

Shown here are a Philadelphia Worm Gear Reducer, a Herringbone Gear Reducer, a Vertical and a Horizontal type Moto-ReduceR.

Philadelphia engineers can recommend the correct type of speed reducer for transmitting power to your machines because the complete line of Philadelphia Speed Reducers includes all types . . . *and they are all made in a wide variety of horsepowers and reduction ratios.* Philadelphia units are designed to combine dependability with efficiency and economy. Their long standing record of trouble-free operation is another good reason for choosing Philadelphia these days when Production without interruption is the goal of all American industry.
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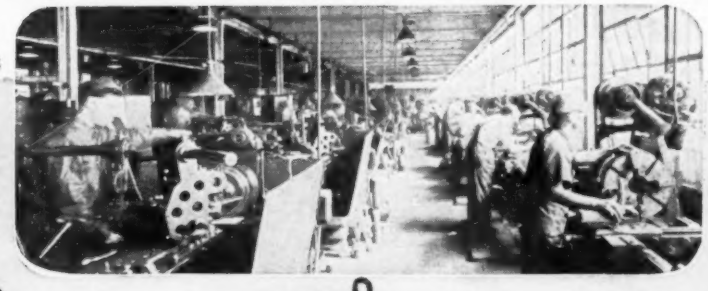
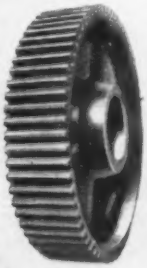


***Philadelphia* LIMITORQUE CONTROL**
operates all types of valves, etc., safely, economically, from convenient stations.



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for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

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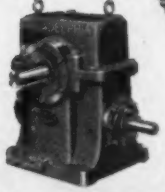
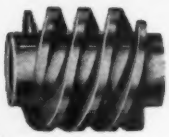
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



***Philadelphia* WORM GEAR SPEED REDUCER**
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

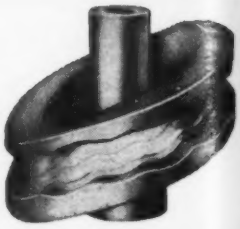
"HARTFORD" for Gears, Cams, Thread-Grinding



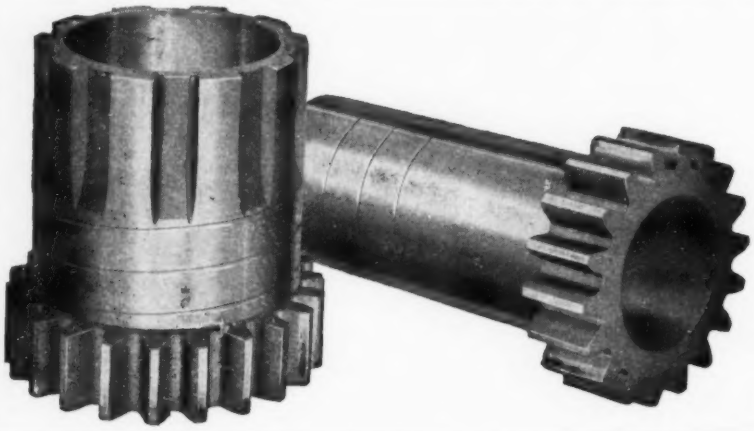
OUR SERVICE INCLUDES:

- . . . cutting gears of every description exactly to specifications
- . . . grinding gears, cams and threads
- . . . furnishing aeronautical parts on a contract basis

You plan and we execute—assuring speedy production, prompt delivery and reasonable price. Send blue prints or samples for estimate.



THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.



ADAMS GEARS

SPUR — HELICAL — WORMS
BEVEL — MITER — RACKS

Splined Shafts A Specialty

THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa

GRANT GEARS

"64 YEARS" MANUFACTURING GEARS

Despite the continued growth of our gear business we are still in position to give each customer the attention they have a right to expect.

We carry a complete stock of standard cut gears and can furnish special gears to your specifications.

GRANT GEAR WORKS
BOSTON, MASS.
ESTABLISHED 1877 BY GEO. B. GRANT

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PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
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Ask for Estimate

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GANSCHOW GEARS

FOR SIXTY YEARS

Spur — SPEED REDUCERS — Worm
ALL TYPES OF CUT GEARS

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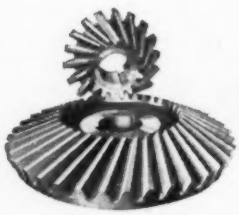

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Straight — Spiral Teeth

ALL TYPES
ALL MATERIALS

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SIER-BATH PRECISION GEAR

DELIVERIES WILL INTEREST YOU

Prompt Production Service made possible by expanded capacity...

If you need gears quickly — get in touch at once with Sier-Bath. Precision gears have been our specialty for 38 years. Sizes from 2" to 52" diameter.

With the completion of our new, modern plant and additional facilities for fast, accurate gear production, Sier-Bath is in position to quote prompt delivery dates on gears to your specifications in almost any quantity. Orders, however, must carry a high priority.

Write, Phone or Wire Your Specifications

SIER-BATH GEAR CO.
NORTH BERGEN NEW JERSEY
Incorporated

THE JOHNSON FRICTION CLUTCH

FLOATING PLATE CONSTRUCTION MINIMIZES DRAG, ABRASION and HEATING in the

"MAXITORQ"
MULTI-DISC CLUTCH

DOUBLE

Construction of the "MAXITORQ" is such that when in neutral, no disc touches the ones adjacent to it. A separator spring between each pair of inner discs spreads these endwise with an accordion action, so that light can be seen between all discs.

Floating plate construction is but one of several new and exclusive improvements developed by Johnson in "MAXITORQ" multiple disc design. Other features include manual assembly without the use of tools and quick and simple manual adjustment.

"MAXITORQ" CLUTCHES are ideal for machine tool and many other industrial applications. They are available in wet or dry plate single, double or cut-off coupling types in capacities from ½ to 5 hp. at 100 R.P.M. Write for detailed data sheets covering "MAXITORQ" CLUTCHES

Single

Write for Multi-Disc Clutch Catalog No. 55 or Consult "Sweet's" or "Thomas Reg."

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Keep 'Em Running
AT TOP SPEED with
CINCINNATI GEARS

Give yourself every opportunity to "Keep 'Em Running". With production schedules being stepped up daily . . . Cincinnati Gears assume more and more importance to your plans. Get the "Right Gear for the Job" by using **"Gears . . . Good Gears Only"**.

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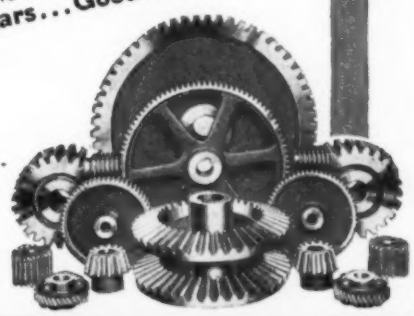
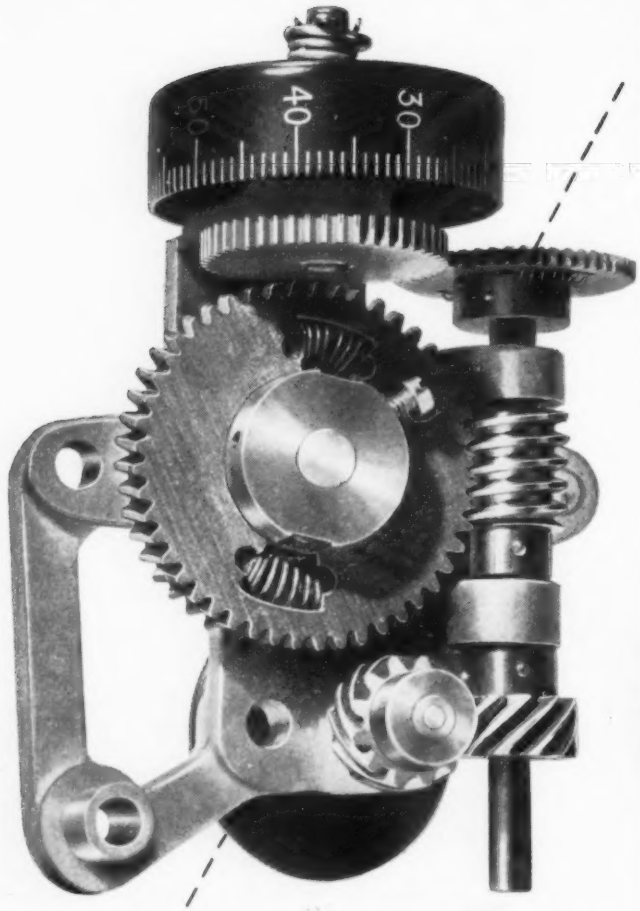
- BEVEL
- SPUR
- SPLINE
- WORM
- SPECIAL



THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. • Cincinnati, Ohio



In base to plane communication one of the vital contributing factors toward the accuracy of pin point tuning is precision gears, and we are proud to say that QUAKER CITY GEARS are playing their part in assuring this accuracy.

Quaker City Gear Works
INCORPORATED

1910-32 NORTH FRONT STREET, PHILADELPHIA, PENNSYLVANIA

Gear Specialties

SPURS • HELICALS • BEVELS
(Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

Gear Specialties
MANUFACTURERS
CHICAGO

2600 W. Medill Av. **Ph. Hum. 3482**

EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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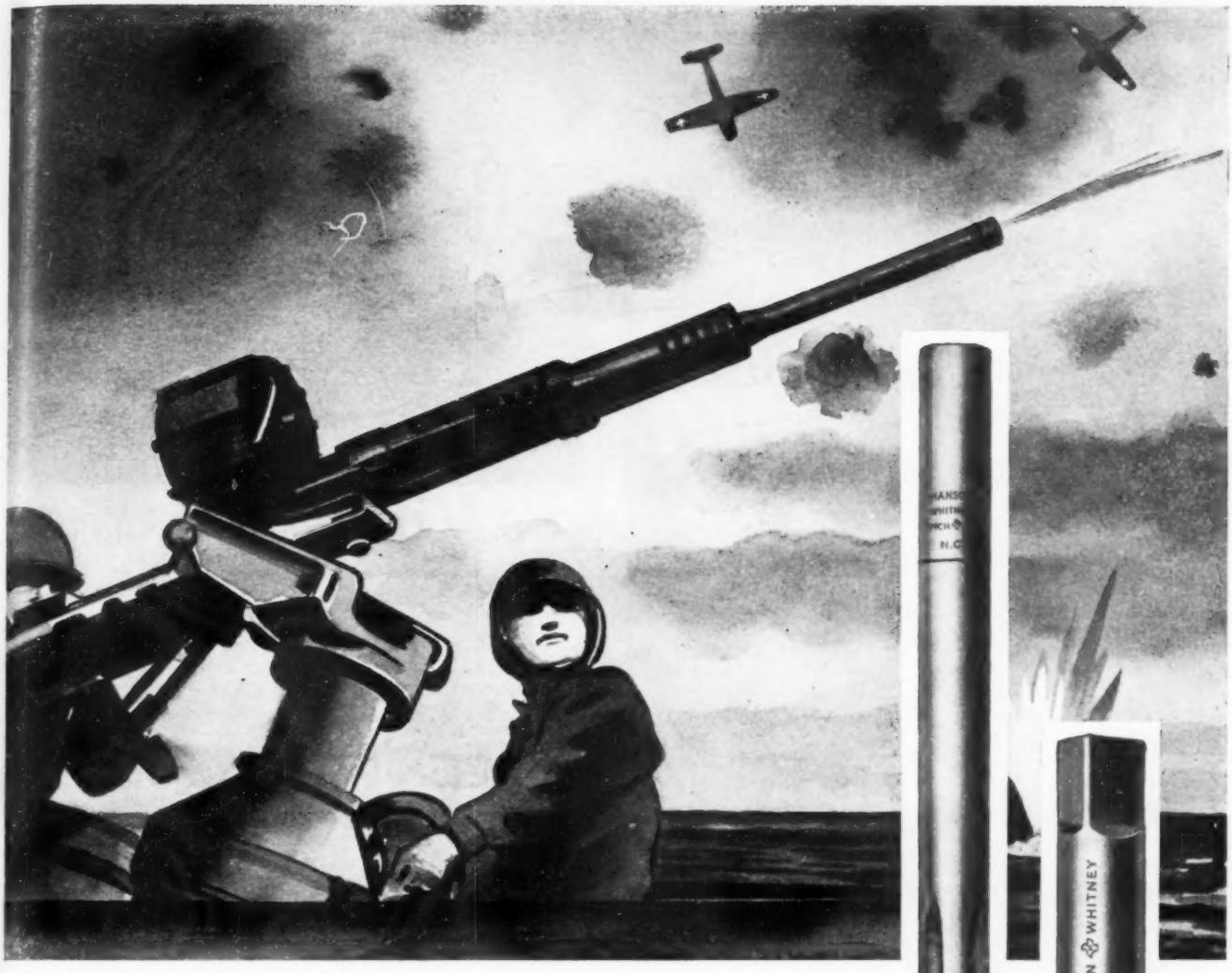
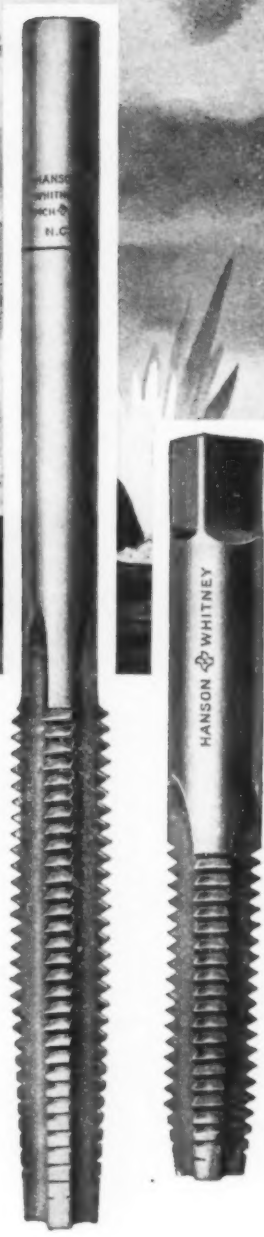
New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY





BATTLE OF THE SKIES

There is just one way to lick the Axis. Our guns must fire straighter, faster and longer. Remember, when you have a production problem to lick, that H-W Taps produce more precision threaded holes in less time . . . deliver longer, more accurate runs between grinds . . . speed up production by reducing down-time and rejects . . . because the exclusive "Hanson Process" of finishing after hardening insures uniform grain structure from tip to shank. Look for this emblem on the taps you buy.

LOOK FOR "HANSON" PROCESS THIS EMBLEM

ARMY E NAVY

THE HANSON WHITNEY MACHINE CO.

HARTFORD CONNECTICUT U.S.A

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HOW TO GET GOOD PAINT ADHERENCE ON SHELLS

One of the important problems now confronting plants making shells is getting good, uniform adherence of paint. But many plants are successfully, easily solving it by merely adding Oakite Compound No. 35, as directed, to the final rinse tank of the washing machine.

The results being secured are so outstanding that you, too, will want further information on how this material can improve paint adherence on your war work. Full details gladly supplied FREE on request. Write today!

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Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE Buy Bonds for Victory **CLEANING**

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Your assemblies are designed to definite standards of precision, to give predetermined reliable performance—without interruption. ABBOTT BEARING BALLS assure the performance expected—they "carry the load as planned."

—Estimates of delivery gladly given—

ROLL ON **ABBOTT** *Bearing* **BALLS**
THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.

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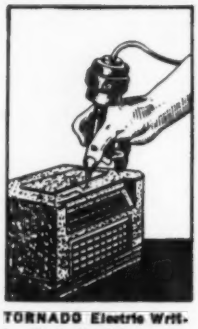
Protect Valuable Tools!



TORNADO Electric Writing Tools and Etchers mark everything of value that might be lost, misplaced or stolen. TORNADO Writing Tool marks brass, marble, tile, glass, plastics, wood, hard rubber, aluminum, steel and bronze.

TORNADO Electric Etcher marks iron, steel and steel alloy products. Burns permanent identification on various types of tools, dies, gauges, plates, gears, etc. Protects your valuable tools and other portable equipment!

TORNADO Electric Writing Tool. Used for marking everything. Easily portable.

Write for complete details

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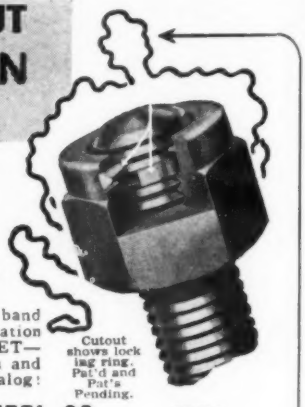
5084 N. Ravenswood Ave., Chicago

TOO TOUGH A NUT FOR VIBRATION TO HANDLE

UNSHAKO
Reg. U. S. Pat. Off.

SELF LOCKING NUT

That locking ring—with its brake band principle—positively prevents vibration from unwinding the "Unshako". YET—it can be backed off with a wrench and used again and again. Write for Catalog!



Cutout shows locking ring. Pat'd and Pat's Pending.

STANDARD PRESSED STEEL CO. BOX 4 JENKINTOWN, PA.

BUZZER INDUSTRIAL *Gas* EQUIPMENT

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No Blower or Power is needed to reach High Temperatures with a "BUZZER" Gas Furnace . . . just connect to your gas supply.

Rectangular Heat Baths

For liquid heat treating baths, soft metal melting, etc.

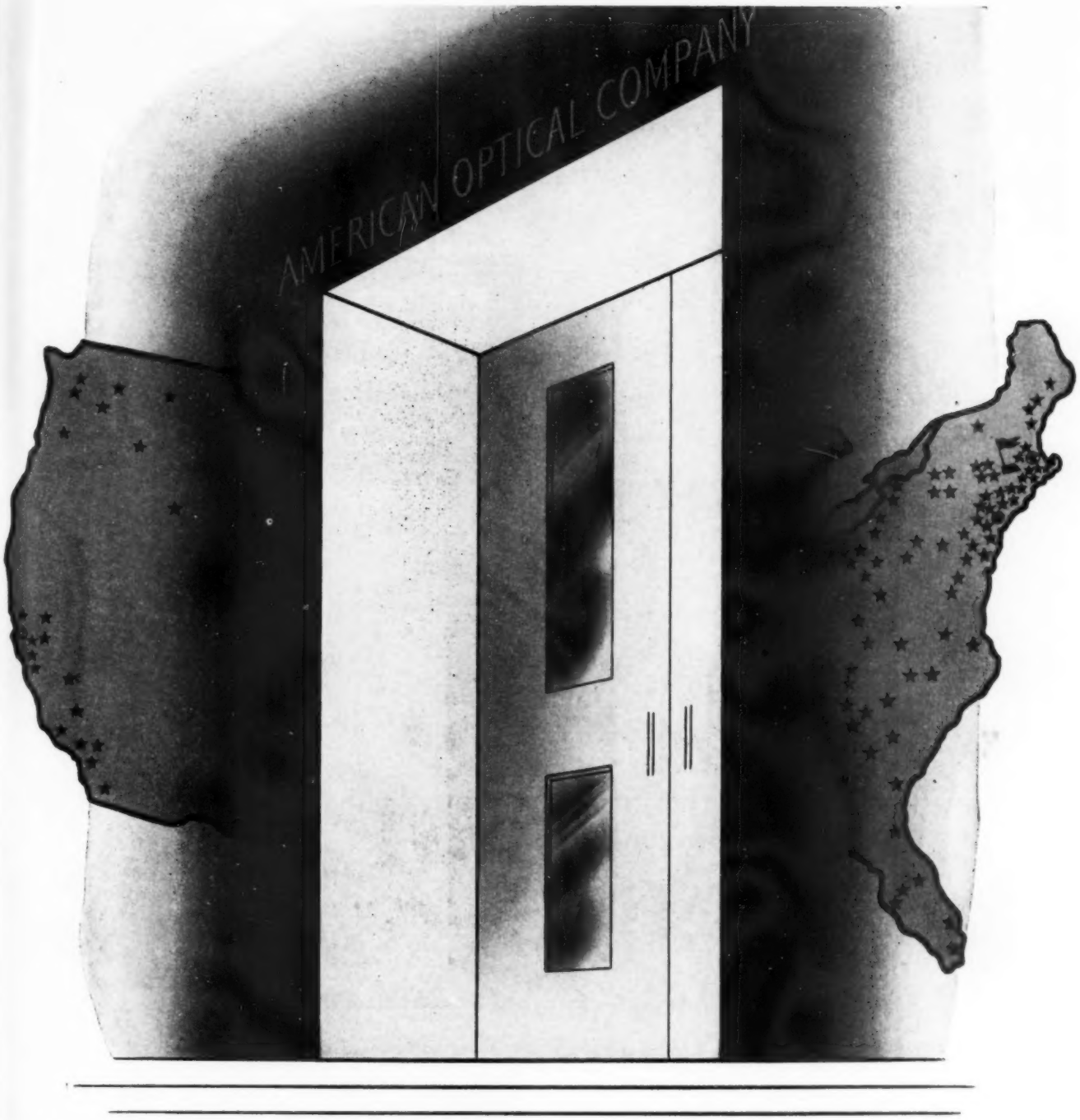
The High Speed Full Muffle Furnace attains a temperature of 2400° F., and is designed for High Carbon and Alloy Steels.

BUZZER Rectangular Heat Baths meet the increasing demands for large liquid Heat Bath Furnaces, and are built in many sizes. Also made in round type pot furnaces

Send for the new BUZZER Catalog showing full line of Gas Furnaces, Burners and other equipment.

Full Muffle Furnace (Bench Type)

CHARLES A. HONES, INC.
121 South Grand Avenue Baldwin, L. I., N. Y.



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Make American Optical Company your base of supply—and the AO Safety Representative your consulting safety engineer. You will be helping to provide your company with a more efficient eye protection program.

American Optical

COMPANY
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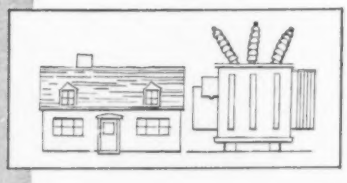
Westinghouse
produces transformers
*as big as a house**
—as small as your hand.



WESTINGHOUSE BUILDS ALL TYPES IN A JIFFY FROM STANDARD PARTS

So we can probably assemble
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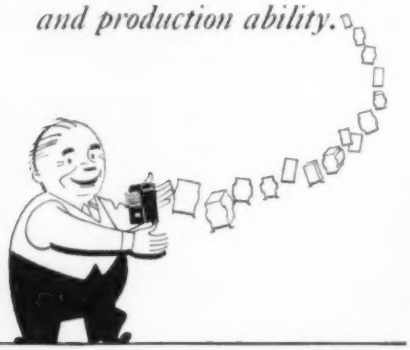
from our stocks of
standardized parts.

ASK HUNDREDS OF PRODUCERS OF WAR GOODS

You'll save time and money
—gain (W) engineering skill
and production ability.



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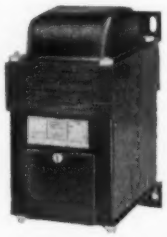
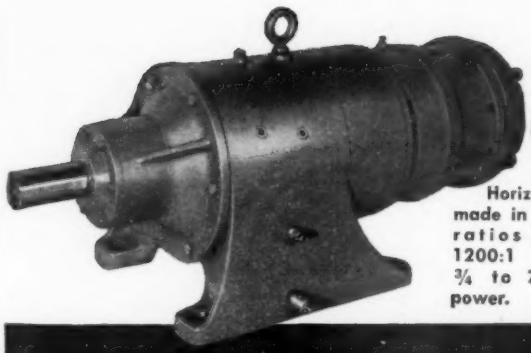


Westinghouse

MT TRANSFORMERS

DEPT. 7-N., WESTINGHOUSE ELECTRIC & MFG. CO., EAST PITTSBURGH, PA.

WESTINGHOUSE



MOTORIZED PLANETARY REDUCER
Horizontal drive, made in 35 sizes in ratios of 10 to 1200:1 and from ¾ to 75 horsepower.

D.O.JAMES
MOTORIZED
SPEED REDUCERS

MOTORIZED HELICAL REDUCER
Horizontal drive—made in 13 sizes in ratios of 1¼ to 9¼:1 and from ¾ to 50 horsepower.

ARMY E NAVY

MOTORIZED WORM GEAR REDUCER
Horizontal drive—made in 11 sizes in ratios of 6 to 80:1 and from ⅛ to 50 horsepower.

SAVE ESSENTIAL AND VALUABLE SPACE

War time requirements make the D.O.James Motorized Reducers a very important *Must* in solving and meeting the power-saving needs of modern industry. Their accessibility and compactness make them most desirable when floor space is limited. Their soundness of design and manufacture insures maximum efficiency with minimum maintenance.

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Established 1888
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MAKERS OF ALL TYPES OF GEARS AND GEAR REDUCERS

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NORGREN LUBRICATORS, installed directly in the air line, inject a fog of oil into the air stream...lubricating every moving part. Check wear during use. Stop destructive corrosion when idle.

Automotic . . . start and stop with the tool. Sight-feed . . . ends guesswork. Size, type, and combination for every requirement. For complete information write . . .

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Over 110,000 Norgren Lubricators now oiling the Battle Lines of Production!

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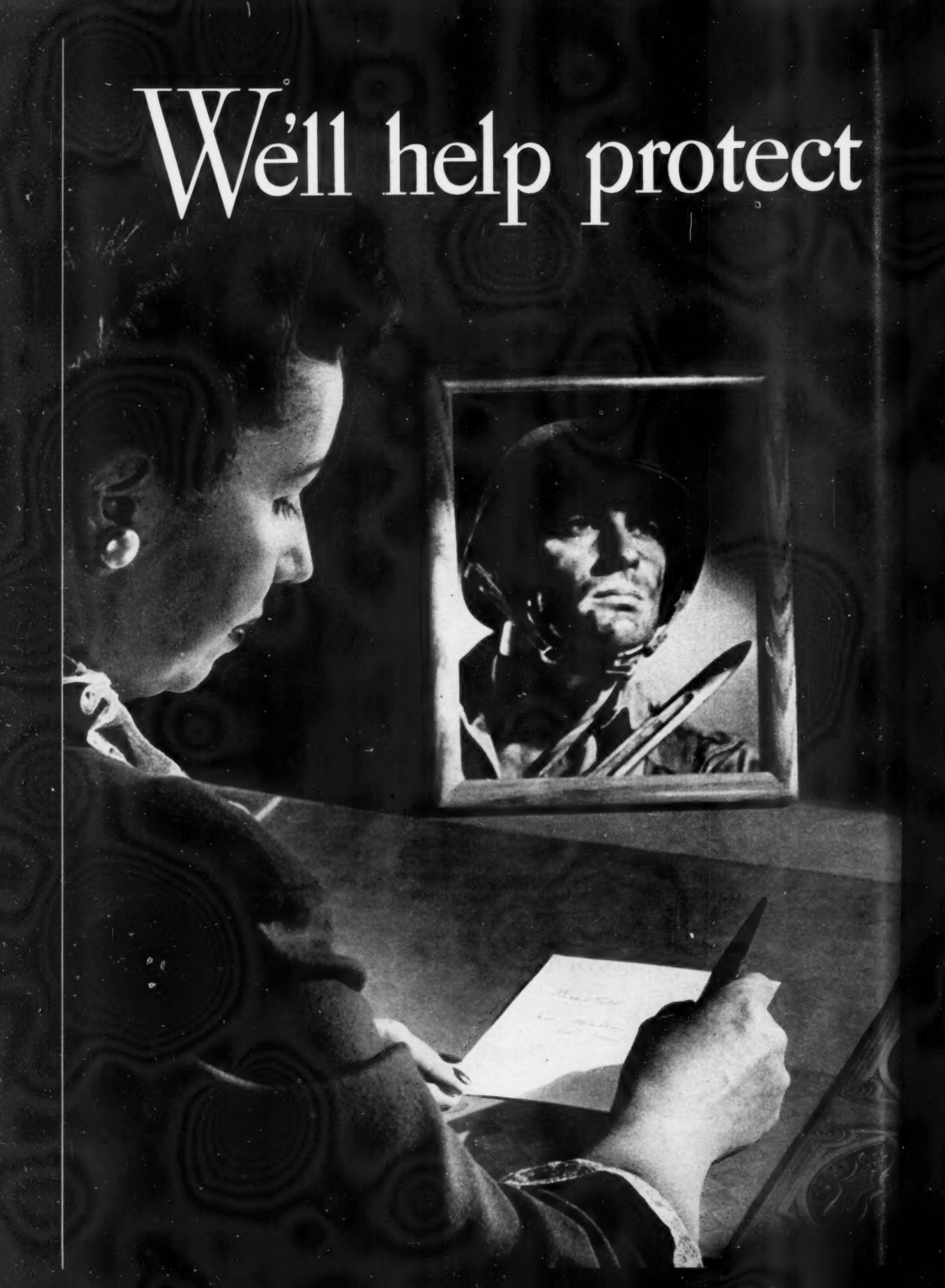
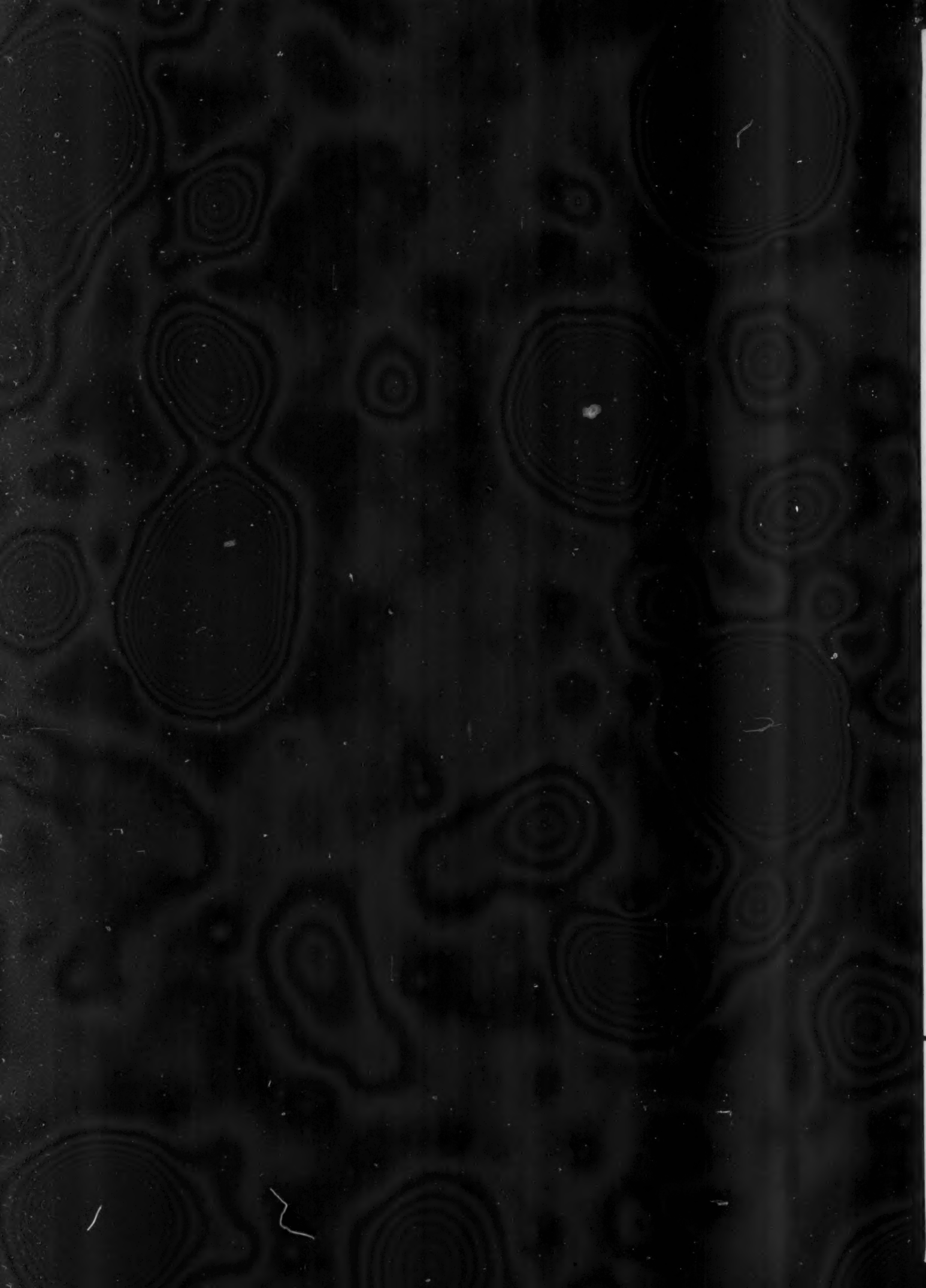
We'll help protect





him, Mrs. Smith!

—but we'll need the full cooperation of every steel fabricating plant to do it

Mrs. Smith—or maybe you're Mrs. Kelly or Cohen or Jankowsky—it makes no difference, because each of you has a boy in the armed forces of our country.

Is he on Guadalcanal, in North Africa, in Australia, in Iceland, Mrs. Smith? That's where our boys are, too. You see, thousands have gone from the mills, mines and offices of the steel industry (more than 13,000 from Republic alone). Thousands more in service are sons or brothers of steel workers.

So maybe your boy, in a sense, is our boy. But does it matter? We want all of them to come home victorious—and safe—just as soon as possible.

And that, Mrs. Smith, is where we, the steel industry, can help—by furnishing enough of the strong, tough alloy steels needed to produce the best, the safest fighting tools in the world for your boy. But—to do so, WE MUST HAVE THE FULL COOPERATION OF EVERY STEEL FABRICATING PLANT.

Fabricators MUST segregate Alloy Steel Scrap—or schedules may COLLAPSE!

Alloy steels cannot be made without nickel, chromium, molybdenum or other critical alloying elements. And such materials are scarce—growing scarcer every day. There just isn't enough to go around now. So what about the future?

Here's what! We must reclaim every possible ounce of alloy from steel scrap.

Every time you machine alloy steels, substantial quantities of alloying elements go into the scrap pile. But unless you keep each lot of alloy steel chips, turnings, shearings and other scrap separate—segregated at the machine and correctly labeled with its grade number (SAE, AISI, NE or other), the maximum value of those alloys may be wasted, even lost.

To charge scrap of unknown alloy content into the furnace may mean possible loss or waste of the alloys—possible ruin of that heat of steel—certainly, disruption of melting schedules. On the other hand, the only way we can determine the alloy content of mixed, unmarked scrap is by melting it down and pouring it into ingots, wasting the time of furnaces and skilled crews which should be producing usable steel.

Chemists and metallurgists must take time to analyze the ingots to determine what and how much alloys they contain. Finally, the scrap ingots must be remelted again when the desired analysis is being produced. That is waste of materials, manpower, time—costly waste.

We know you're busy—that you face many problems—*BUT THIS IS EQUALLY IMPORTANT*—and can be taken care of in a hurry. Just take a few minutes *right now* to issue an order to your plant to segregate alloy steel scrap, *mark* it correctly and return it *promptly*. While you're at it, make some one responsible for checking at least once a week to see that your order is being carried out. You'll help protect Mrs. Smith's son—maybe your own son—and, incidentally, the American System of Free Enterprise which made your business possible.

REPUBLIC STEEL — PRODUCTION FOR VICTORY

This Advertisement Sponsored by

REPUBLIC STEEL CORPORATION

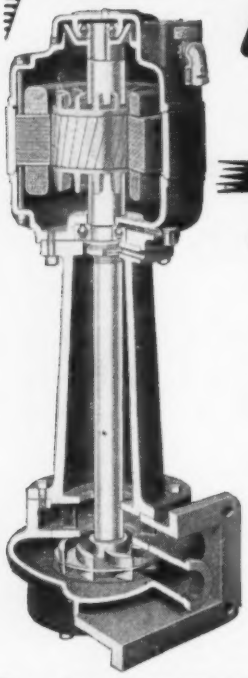
Alloy Steel Division Sales Offices: Massillon, Ohio • General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division • Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company • Export Department: Chrysler Building, New York, New York

In Cooperation with the U. S. Government's Salvage Campaign

Poster size reprints of this advertisement and wall cards giving official W.P.B. alloy scrap classifications will be sent upon request.

GUSHER COOLANT PUMPS



GIVE SPEEDY, TROUBLE-FREE OPERATION

Reduce "absenteeism" for your machines by equipping them with Gusher Coolant Pumps. Sturdy vertical shaft, double suction intake and built-in motor make "Gushers" dependable and trouble-free. Split-second control gives you copious flow of coolant, when you want it—where you want it.

Write for data and specifications.

This is an internal discharge type. No outside piping necessary.

THE RUTHMAN MACHINERY CO.
1809 READING ROAD CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

For SPEED, ACCURACY and CLOSE TOLERANCE Assembly and Inspection—

Production methods today demand streamlined efficiency in men, machines and tools. Surface plates of precision accuracy must contribute, as never before, to unparalleled accuracy in production and of these the Smith Master Surface Plate is an outstanding example. Plants engaged in aircraft and ordnance production throughout the country have expressed their complete satisfaction by frequently reordering. For your sensitive, precise and accurate inspection depend on Smith Master Surface Plates. Prompt delivery on a large variety of standard sizes up to 48"x96". For prices and delivery wire, phone or write.

SMITH TOOL & ENGINEERING CO.
Precision Measuring Equipment
851 N. Sandusky Ave. Bucyrus, Ohio

Smith Master SURFACE PLATES ARE Masters

36" x 68" Smith Master Surface Plate
Elliptical Rib Construction — an exclusive Smith Feature

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LET the largest, most completely equipped cam milling plant in the mid-west handle your cam problems. All sizes of drum, face, groove or other styles of cams cut to order in quantities of one or one thousand. Send specifications or blueprints for a quotation on your requirements.

KUX MACHINE COMPANY
3930-44 W. HARRISON, ST. CHICAGO, ILL.

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No. 15
MOTOR DRIVEN
SURFACE GRINDER
HAND FEED

FOR SMALL DELICATE JOBS.

6 x 18" Capacity
1½ H.P. Motor
10 x 1" Wheel

Reasonably Prompt Delivery

Many manufacturers on war work are using large batteries of these grinders.

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GALLMEYER & LIVINGSTON CO.
330 Straight Ave. S. W.
GRAND RAPIDS MICHIGAN

TO HIT 'EM H-A-R-D-E-R

THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* attention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

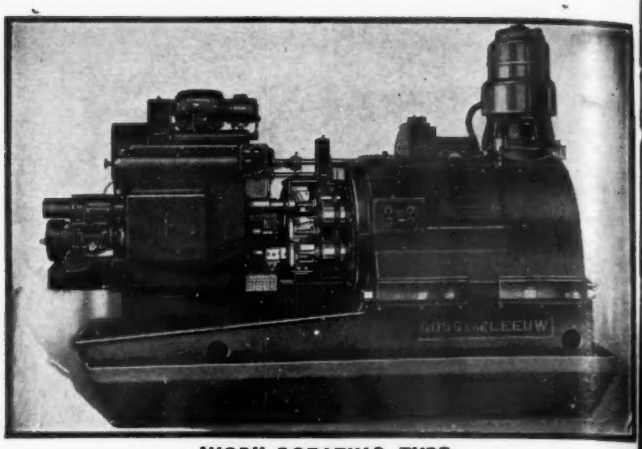
And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

★ ★ ★

You've done your bit Now do your best!

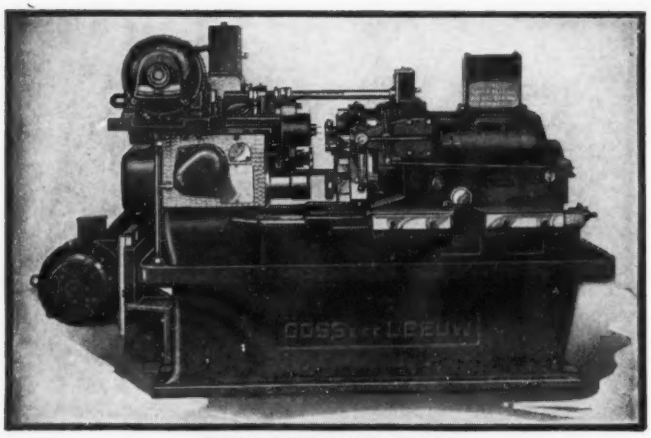
This space is a contribution to victory today and sound business tomorrow by AMERICAN MACHINIST

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

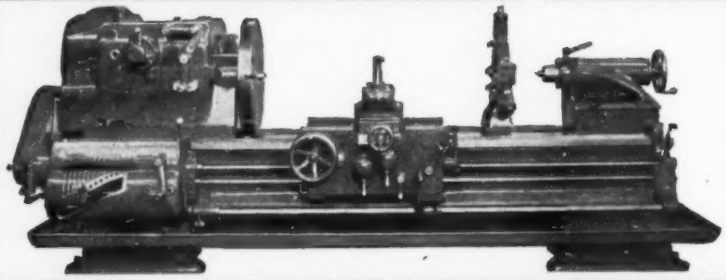
4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

SPRINGFIELD GEARED HEAD LATHES



for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

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Production executives will find in this exactly the type of information needed by new workers. Removes the chief obstacle to the novice's progress—the simple fact that he doesn't know the names of things. Covers measuring, gaging, marking, holding, cutting, forming and milling tools. Basic instruction data which will save you months of preparation time.

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In making an efficient cutting tool, whether it be a hob, broach or cutter, the milling operation is of extreme importance. Precise and skillful craftsmanship is required to produce the tool exactly as designed. This is particularly true when special construction features are incorporated.

The illustration above shows an Illinite Slab Milling Cutter being milled with extra large fillets designed to follow the natural chip curvature for maximum removal of material. This is typical of the special construction provided in Illinite cutters to achieve utmost efficiency in accordance with the specific purpose of the tool.

Discuss your tool design problems with an Illinois Tool engineer—his suggestion will point the way to increased production through greater tool efficiency.

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Official Signal Corps Photo

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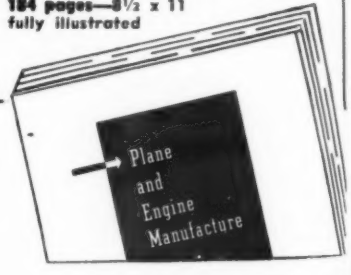

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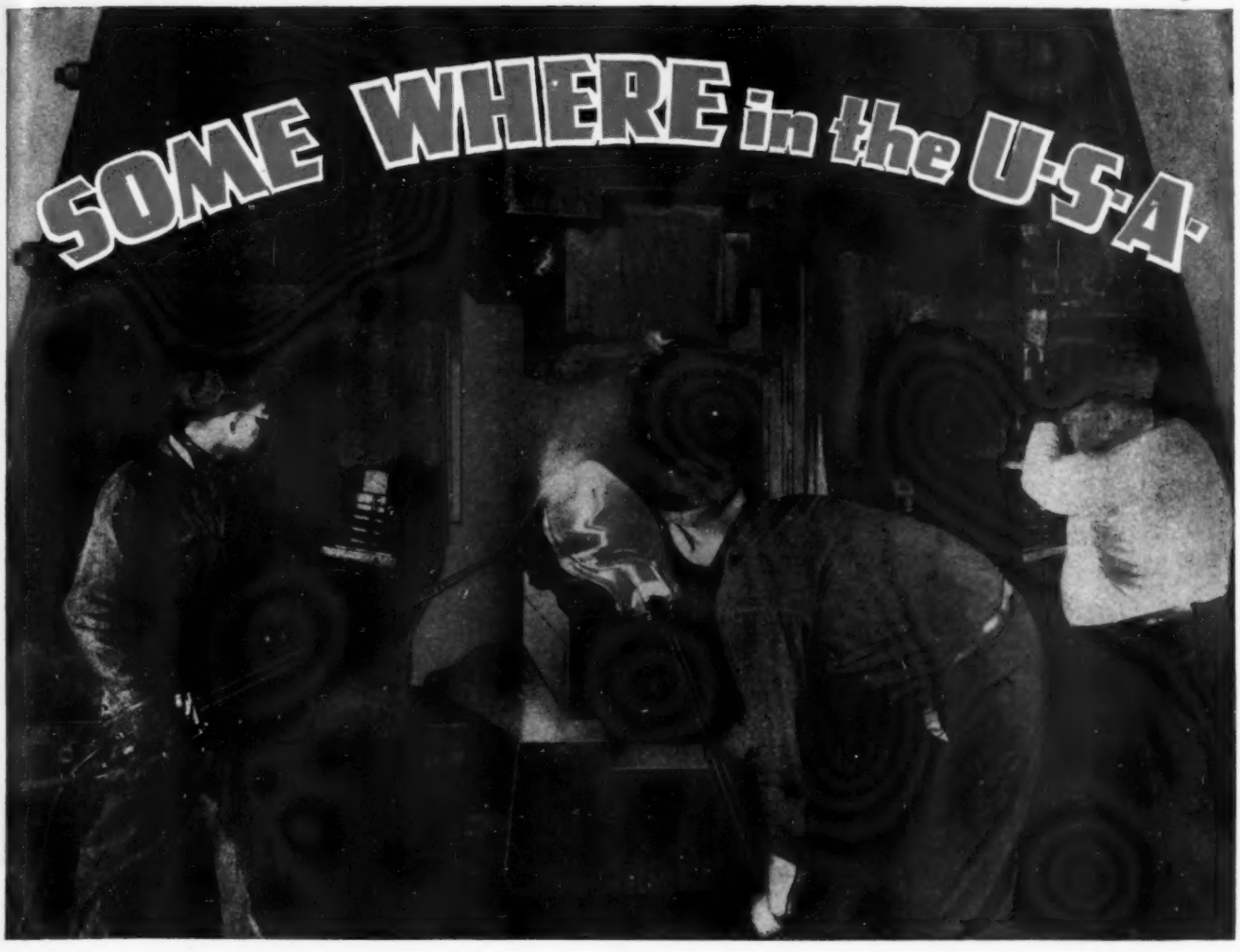

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That trio above at a 35,000-pound Erie Hammer operate one of the most responsive, most powerful drop hammers that has ever been built. This company,* operating 16 Eries somewhere in the U. S. A., is the second largest producer of aluminum forgings in the country.

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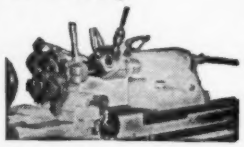
DON'T WAIT FOR TURRET LATHES

Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing



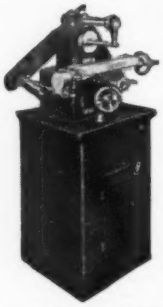
● This new modern TOOL-POST TURRET (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held.

6 Days Delivery

Pat. Pending

4-Tool Tool-Post Turret

● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (below right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL-FEED LEVER. Jefferson Turrets are real production tools—substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market



The Jefferson Bull-Dog Precision Milling Machine. Obtainable Power or Hand Feed.

5-Tool Tail-Stock Turret

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● **ALSO—*Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.***

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ERICKSON *Precision* COLLET CHUCKS

One Erickson Collet Replaces 7 Single Purpose Collets.

Above: Special Model 202 chuck used in Aircraft Industry

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HOW AND WHY

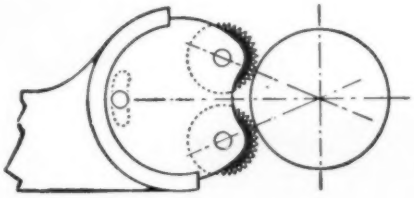
WILLIAMS' TOOLS AID WAR PRODUCTION

USE OF WILLIAMS' KNURLING TOOL HOLDERS

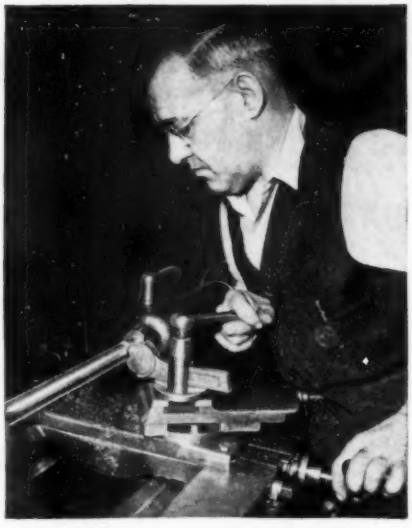
● Knurling differs from most lathe operations in that it is not a *cutting*, but rather an *embossing* or extruding operation. Knurling actually increases the diameter of the work.

Whenever possible, work to be knurled should be held between centers. Long and extremely light pieces should be supported with a Steady Rest. In other words, the work must be prevented from springing away from the cross pressure of the knurling rolls.

Set the Knurling Tool Holder well back in the Tool Post and so positioned that top and bottom rolls are equidistant above and below center of the work, as sketched below. Tool Post screw should be securely tightened.



With lathe in slow speed, begin at Tailstock end so as to feed towards Headstock. Force the Knurling Tool into the work—*abruptly*—to approximately full depth of the knurl. This should be accomplished *before* rolls can make one complete revolution. If the knurling is to start at the extreme end of the work, start the Tool so that only half the width of the roll face contacts the work when forced in with the hand cross feed.



The self-centering Head of this Williams' No. 1-K Holder assures equal pressure of both *Knurling Rolls against the work.*

Engage the longitudinal power feed and let the Tool travel across the face of the work for desired distance. Now reverse direction of carriage travel, without removing Tool from the impression, and feed back across the face of the work. Slight additional cross feed may be applied, as the carriage reverses, to further sharpen knurling.

Some machinists use oil when knurling—others prefer air pressure so as to blow all chips clear. Illustration below shows sample of knurling by both methods. Actually both samples are of about equal quality.

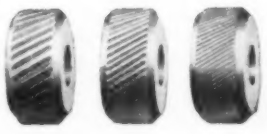
Unretouched photo of work sample. Air pressure used on knurling at left end — oil on knurling at right. Piece is 3/4" mild steel bar; coarse knurled with Williams' No. 11-K Holder; spindle speed 250 R.P.M.; both ends knurled with one pass up and reverse.

WILLIAMS' KNURLING TOOL HOLDERS

Nos. 00-K to 2-K, 4 sizes, 5/16" x 3/4" x 5" to 5/8" x 1-3/8" x 7-1/2" with self-centering Head and fitted with ONE pair of knurls.

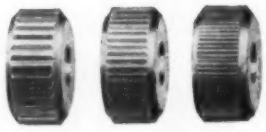
Nos. 11-K and 12-K, 2 sizes, 1/2" x 1-1/8" x 6-5/8" and 5/8" x 1-3/8" x 6-5/8" with Revolving Head and THREE pairs of knurls, for fine, medium and coarse work.

KNURLS FOR WILLIAMS' HOLDERS



DIAMOND PATTERN

STRAIGHT-LINE PATTERN



Both patterns furnished in pairs, to fit standard makes of Knurling Tools, in 3 different pitches: Coarse, 14 pitch; Medium, 21 pitch; Fine, 33 pitch.

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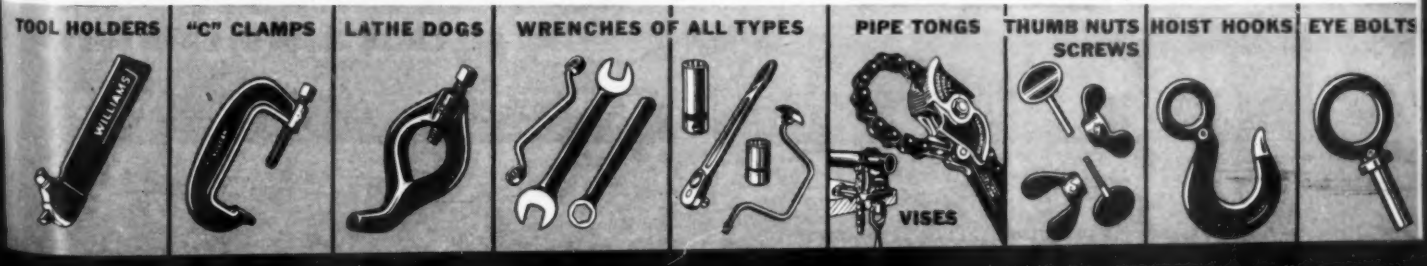

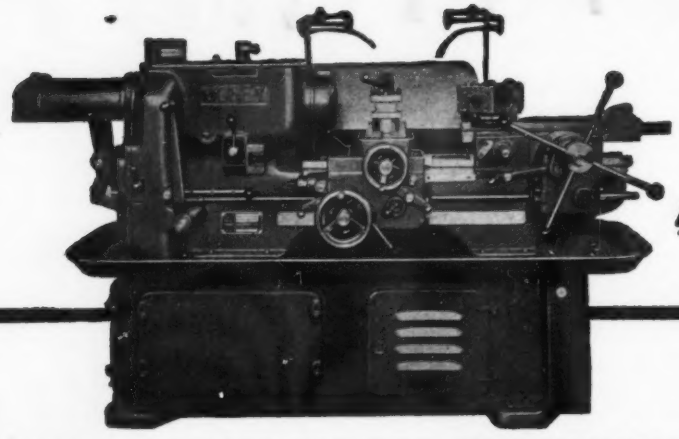

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1" hole in spindle, 6" turning length, 14" swing over bed. Infinite spindle speeds 60 to 2000 RPM, constant speed motor, 1800 RPM.
Ask for Circular No. 629A

No. 3 TURRET LATHE
1½" hole in spindle, 10" turning length, 16½" swing over bed. Infinite spindle speeds 55 to 1800 RPM, constant speed motor, 1200 RPM.
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No. 4 TURRET LATHE
2" hole in spindle, 12" turning length, 19½" swing over bed. Infinite spindle speeds 35 to 1500 RPM, constant speed motor, 1200 RPM.
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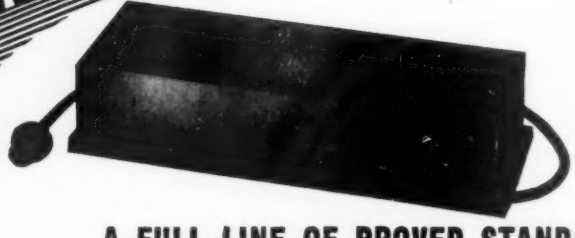
Style B Face Plate—in standard diameters from 10⅜" to 36⅜" inclusive.



No. 617 Bar Pole Face Rectangular Magnetic Chuck.

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Mr. Postwar: That's fine —I've got to take advantage of every detail to protect production.

Greater Protection

320

Developed especially to assure greater protection than the usual open motor, Century Form J, General Purpose Motors have a protecting hood over the upper half of the motor, preventing falling solids or dripping water from entering vital motor parts. This is particularly advantageous when motors are installed *below the work level* on machine tools — constantly exposed to falling chips of metal.

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Write for complete detailed specifications.

Can be furnished either as a Plain Cutter and Reamer Grinder or as a Universal Machine with any or all attachments. Ideal for shop or tool room.

When furnished as a Universal Machine, (known as 4U) both cylindrical and internal grinding atttachments including motor and control and a 4" Universal Union Scroll Chuck are included.

Features include: graduated head swivelling 90° each side of center; head and spindle of sturdy construction for heavy work; table rests full length upon longitudinal slide and is adjustable for aligning centers for straight or taper grinding.

Swing over table 8½"
Longitudinal table travel 16"
Table surface 5½" x 28"

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Manufacturers of Drilling Machines, Tool Grinders, and Hand and Automatic Polishing and Grinding Machines.

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Precision Lathe

★ This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

★ If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

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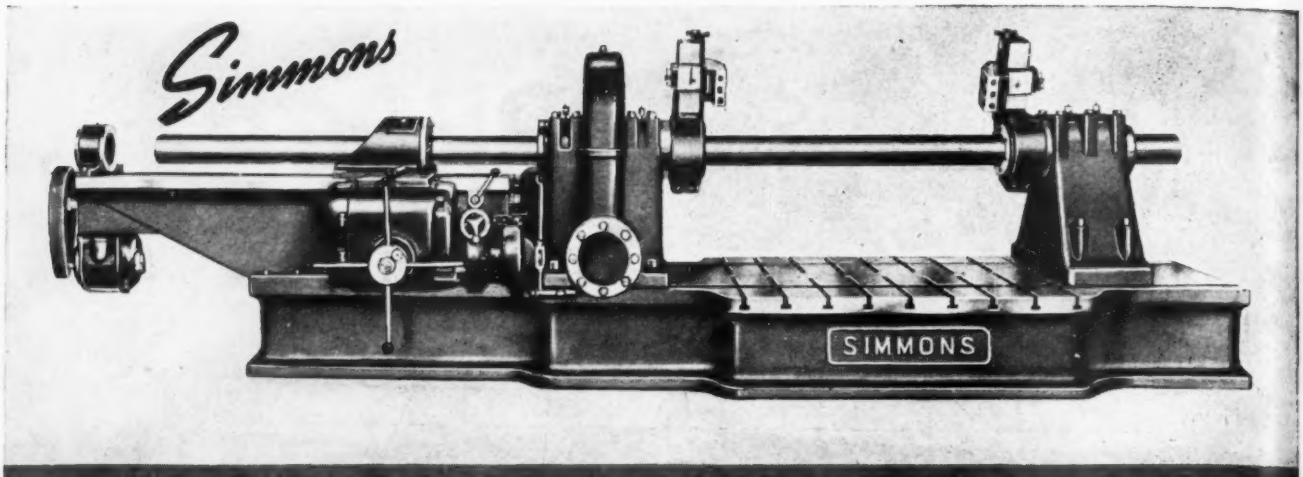

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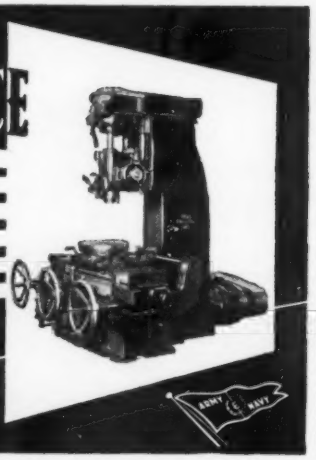
- VERTICAL MILLERS
- INJECTION MOLDING MACHINES

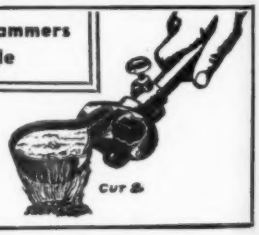


REED-PRENTICE CORP. MACHINE TOOLS WORCESTER MASS., U. S. A.

Remelt and Cast Your Lead Hammers with the Field Mould and Ladle

Save time and money—keep lead hammers in good condition at all times—easy to use—fast. Made in 7 sizes for hammers from 1 to 11 lbs. Write for details.
Also, Lead Hammers, sizes 1 to 15 lbs. always in stock.

JOHNSON TOOL CO., INC.
East Providence Rhode Island, U.S.A.



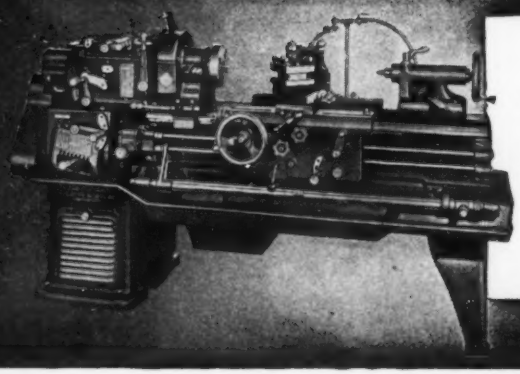
Write for Bulletin

STEVENS MILLING MACHINE VISES

5 in., 6 in. and 7 in. sizes
All parts Interchangeable

JOHN B. STEVENS INC.
474 Canal St., New York, N. Y.

CINNATI



Speed Mass Production of Aircraft and Munitions

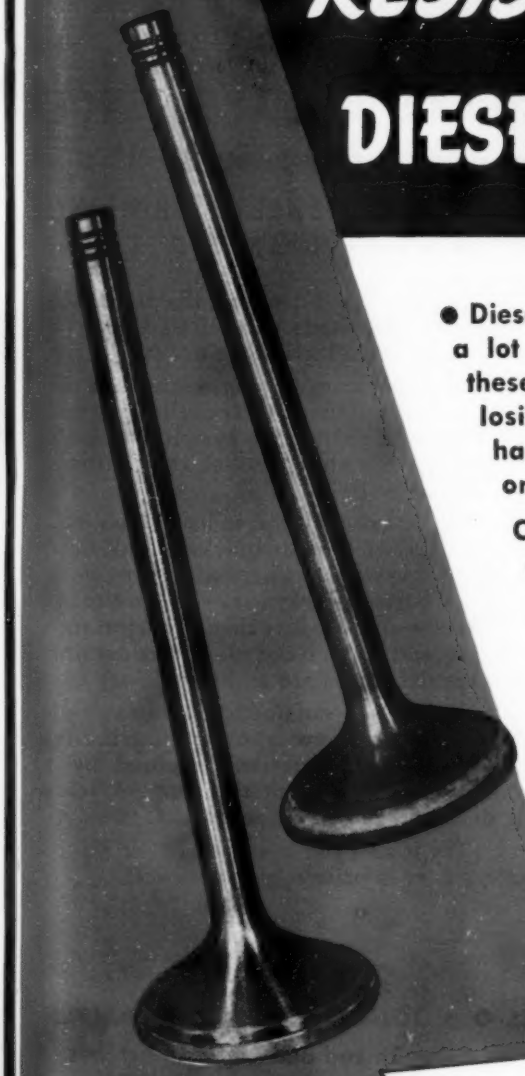
In continuous operation on precision jobs, Cincinnati Lathes are speeding war production. Their wide range of feeds and speeds, plus the extra heavy construction of bed and ways, permit efficient operations on any job in any material. Write for latest catalog giving detail of 14" to 30" sizes.

THE CINCINNATI LATHE & TOOL CO.
Rogers Road, Oakley Cincinnati, Ohio
SPECIALISTS SINCE 1906

COLMONOY No. 4

HARD FACING ALLOY

RESISTS SEVERE WEAR IN DIESEL ENGINE VALVES



● Diesel engine valves, in locomotive service, must take a lot of punishment. Roadbed cinders and dust caused these valves to fail in service, wearing down rapidly and losing compression. To salvage the valves already on hand an undercut was made as shown in the illustration on the left.

COLMONOY No. 4 was applied in the undercut by oxy-acetylene welding, and subsequently machined and ground. Due to the low temperature at which the application was made there was absolutely no distortion in the valves.

Service records show that the great abrasion resistance of COLMONOY completely solved the problem of wear.

There is a grade of COLMONOY for every hard facing need. If you have a wear problem, COLMONOY engineers will be glad to make recommendations and suggest proper methods of application.

WALL-COLMONOY CORP.
720 Fisher Building, Detroit
Branch offices in New York City, Bloodell, N. Y., Chicago, Tulsa, Los Angeles and in Canada.

COLMONOY
HARD FACING ALLOYS AND OVERLAY METALS

WALL-COLMONOY CORPORATION—DETROIT

Here's What You're Fighting For...

. . . your way of life! Every man interprets it a little differently, but to us all it means a car, a radio, a refrigerator; the right to those things that make our daily life pleasanter, more convenient, more exciting. Today Weatherhead plants are producing vital parts for planes, tanks, ships, trucks and munitions at the rate of *millions every twenty four hours.* The coming of Peace will find us prepared to join with you in building durable goods the world will want as well as many strange new devices being born in the war.

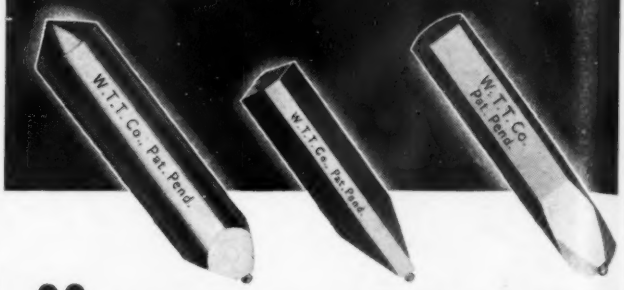
Look Ahead with

Weatherhead

THE WEATHERHEAD CO., CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Branch Offices:
Detroit, Los Angeles, New York and St. Louis

EXPERIENCE
is a Great Teacher!



33 YEARS OF EXPERIENCE
backs the development of this
NEW TYPE THREAD GRINDING DIAMOND TOOL!

Here is a new type wheel dressing diamond tool that brings new standards of performance and economy to your thread grinding operations.

It gives better performance because it utilizes the hard characteristics of the natural uncut diamond —and yet it is of a shape that permits not only straight dressing but angle, radial and multiple form dressing as well.

It gives greater economy because its cleaner cuts mean forms are obtained quicker and hold longer—fewer dressings are needed—more work can be ground between dressings—down time is greatly reduced—and because this precision tool can be made and reserviced on a production basis, quicker deliveries are assured.

And your assurance of satisfaction is the knowledge that back of this new type thread grinding diamond tool is the experience gained by a manufacturer who has spent the past 33 years building diamond tools of fine quality.

Try it and you'll agree . . .
there is no substitute for experience!

★ ★ ★

For use on

EX-CELL-O • JONES & LAMSON • DALZEN
And All Other Thread and Radius Machines

For Forming Wheels That Grind
WHITWORTH • BUTTRESS • ACME
And Any Other Special or Standard Thread

Available Only from

WHEEL TRUEING TOOL COMPANY

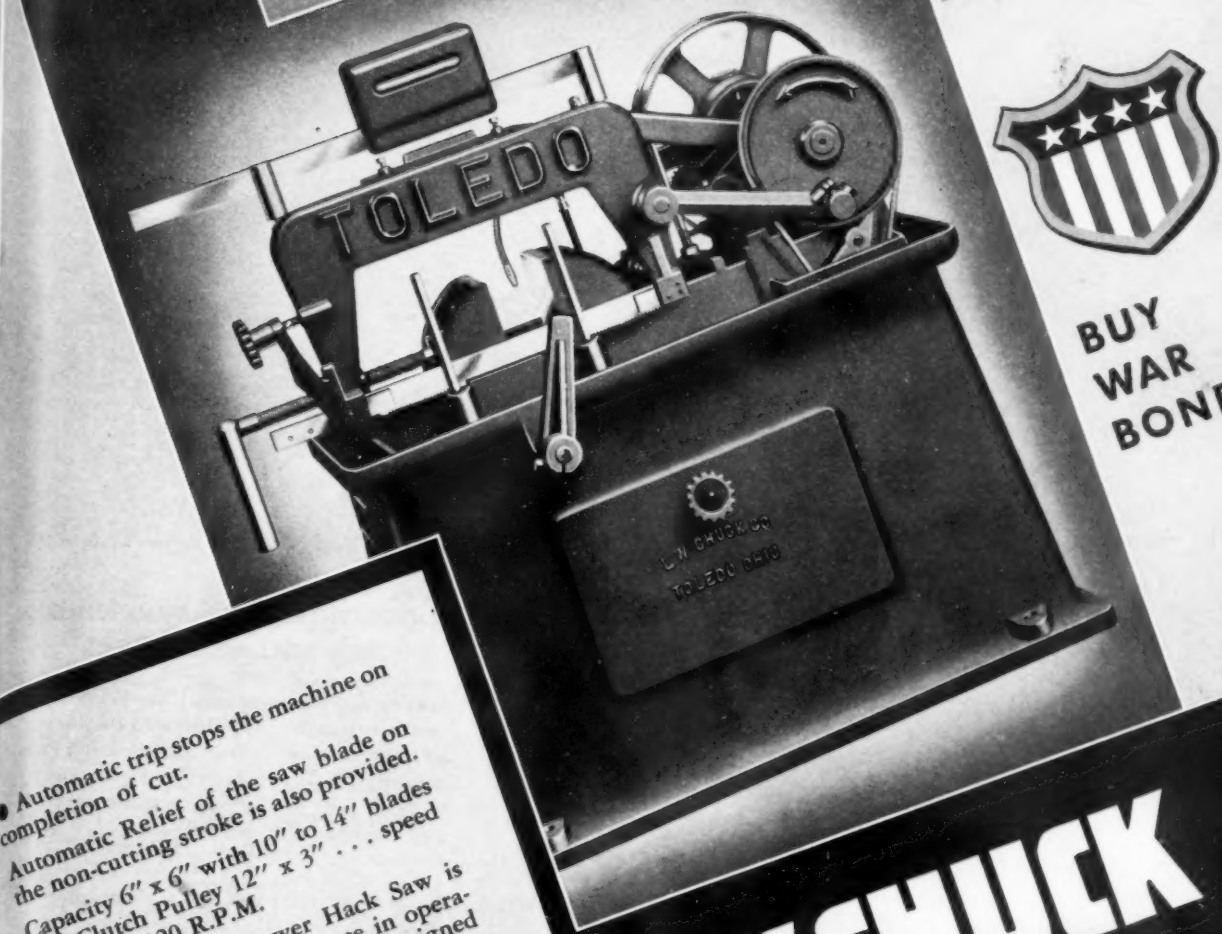
3200 W. DAVISON • DETROIT, MICHIGAN

L-W

HIGH SPEED POWER HACK SAWS
LOW PRICE · · · HIGH QUALITY

The Ideal Saw for any Shop

GRAVITY FEED
LENGTH GAUGE
EXPANDING CLUTCH
DOVETAILED SAW FRAME GUIDE



BUY WAR BONDS

• Automatic trip stops the machine on completion of cut.
Automatic Relief of the saw blade on the non-cutting stroke is also provided.
Capacity 6" x 6" with 10" to 14" blades . . . Clutch Pulley 12" x 3" . . . speed of pulley 120 R.P.M.
This heavy duty Power Hack Saw is highly efficient and accurate in operation. The Saw Frame is so designed that maximum rigidity is obtained. The sliding bearing is dovetailed to fit the arm and is adjustable in all directions. Belt drive, only $180.15.
Furnished, on request, is the 3-speed V-belt Motor Drive Arrangement . . . permits three speeds varying from approximately 90 R.P.M. to 130 R.P.M.; less motor—$25.90.
Motor recommended for use with drive arrangement—½ H.P. standard speed 1725 R.P.M.

L-W CHUCK Company

1-7 N. ST. CLAIR ST., TOLEDO, O.

Also manufacturers of
Demagnetizers
Lathe Chucks
Magnetic Chucks
Milling Machine Vises
Dividing Heads

In Times Like These Bearings MUST Last!

YOU'RE fighting this war in your factory . . . on your production line . . . with your *bearings!* Naturally, the armed forces have first call on bearings . . . so make yours last. Mount your BCA bearings correctly . . . care for them properly . . . and they'll provide the long, efficient service for which they're designed.

BEARINGS COMPANY OF AMERICA, LANCASTER, PA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

SUGGESTIONS FOR MOUNTING BCA BALL BEARINGS

1. Keep bearings wrapped. Keep bearings in the original wrappings until they are to be applied. Each BCA Ball Bearing is thoroughly cleaned and coated with pure neutral oil or grease and carefully wrapped in heavy, non-absorbent paper at the factory.

2. Clean housings and shafts. The housings and shafts that are to receive the bearings must be carefully cleaned to remove all chips from machining, core sand, filings or other foreign matter.

3. Do not remove protective coatings. When the bearings are removed from wrappers, it is best to allow the slushing grease and oil to remain on the bearings. Do not try to remove unless contaminated by dirt or other foreign matter.

Treat Bearings Right!
They're in the Fight!

Why Ozalid clicks with engineers and draftsmen

STUDY THE cross-sectional drawing of an Ozalid Whiteprint Machine ... It tells much of the story.

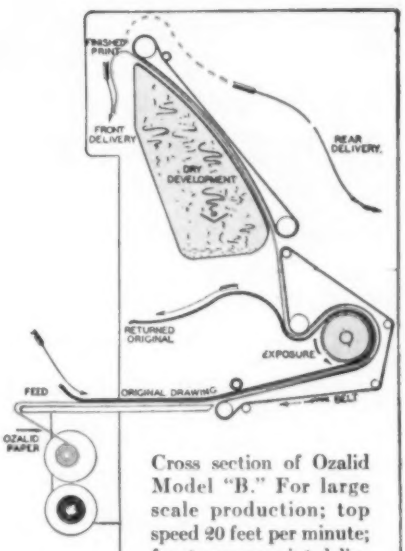
Printmaking is reduced to two operations—Exposure and Dry Development . . . the liquid baths, the plumbing connections, the driers which for fifty years have been a part of blueprinting *are eliminated.* SIMPLIFIED PRINTMAKING allows simplified design – and an Ozalid Machine is so compact that it may be installed right in the drafting room where it can be operated by anyone.

What's most important now, though, is the fact that the Ozalid Process saves thousands of manhours . . . and that means a big "head start" in war production. When you want to change part of a drawing, it's never necessary to redraw any line which remains the same in the new design. You merely make a transparent print of the original tracing . . . delete the obsolete lines with a corrector fluid . . . and draw in the new design. It's that easy—no Van Dyke tieups, no photographic equipment required.

Ozalid Whiteprint Machines are designed for large scale, medium, and occasional print production. Adopt Ozalid . . . and make positive reproductions *direct* from *your* engineering drawings, charts, and letters.

WRITE FOR "SIMPLIFIED PRINTMAKING."

It shows how leading manufacturers save time, labor, and materials with the Ozalid Process; also contains samples of whiteprints having blue, black, and maroon lines on white backgrounds.



Cross section of Ozalid Model "B." For large scale production; top speed 20 feet per minute; front or rear print delivery; many new features.

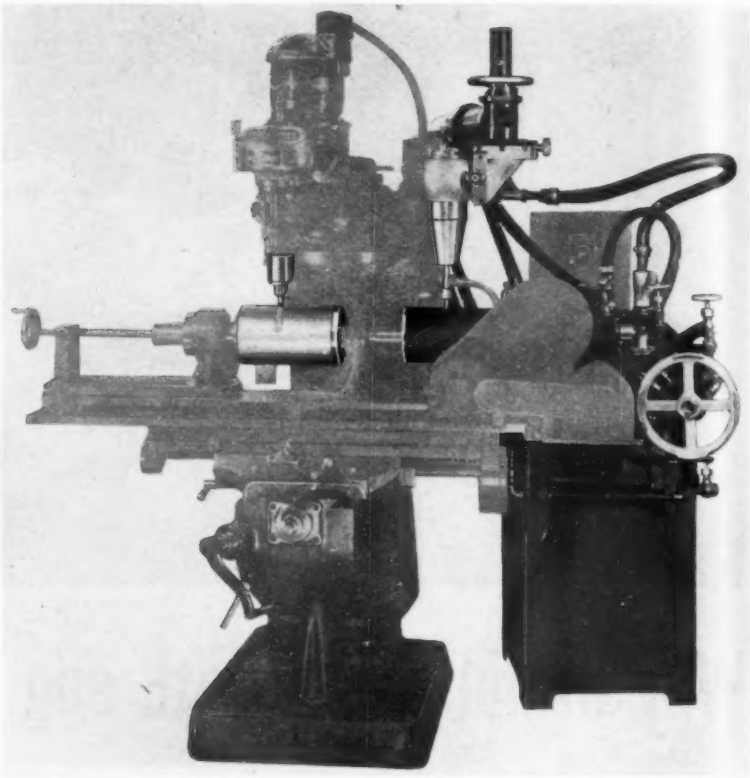
OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

Johnson City, N. Y.

Turchan FOLLOWERS

INCREASED PRODUCTION OF THIS VITAL GUN PART... 500%!



This two-dimension Turchan Follower, mounted on a standard type vertical mill, is being used by one of the nation's largest ordnance manufacturers to produce fire control cams for aerial machine guns. And production of the cams—one of the most vital parts in the gun's entire mechanism — has been stepped up more than 500 per cent. We repeat: MORE THAN 500 per cent!

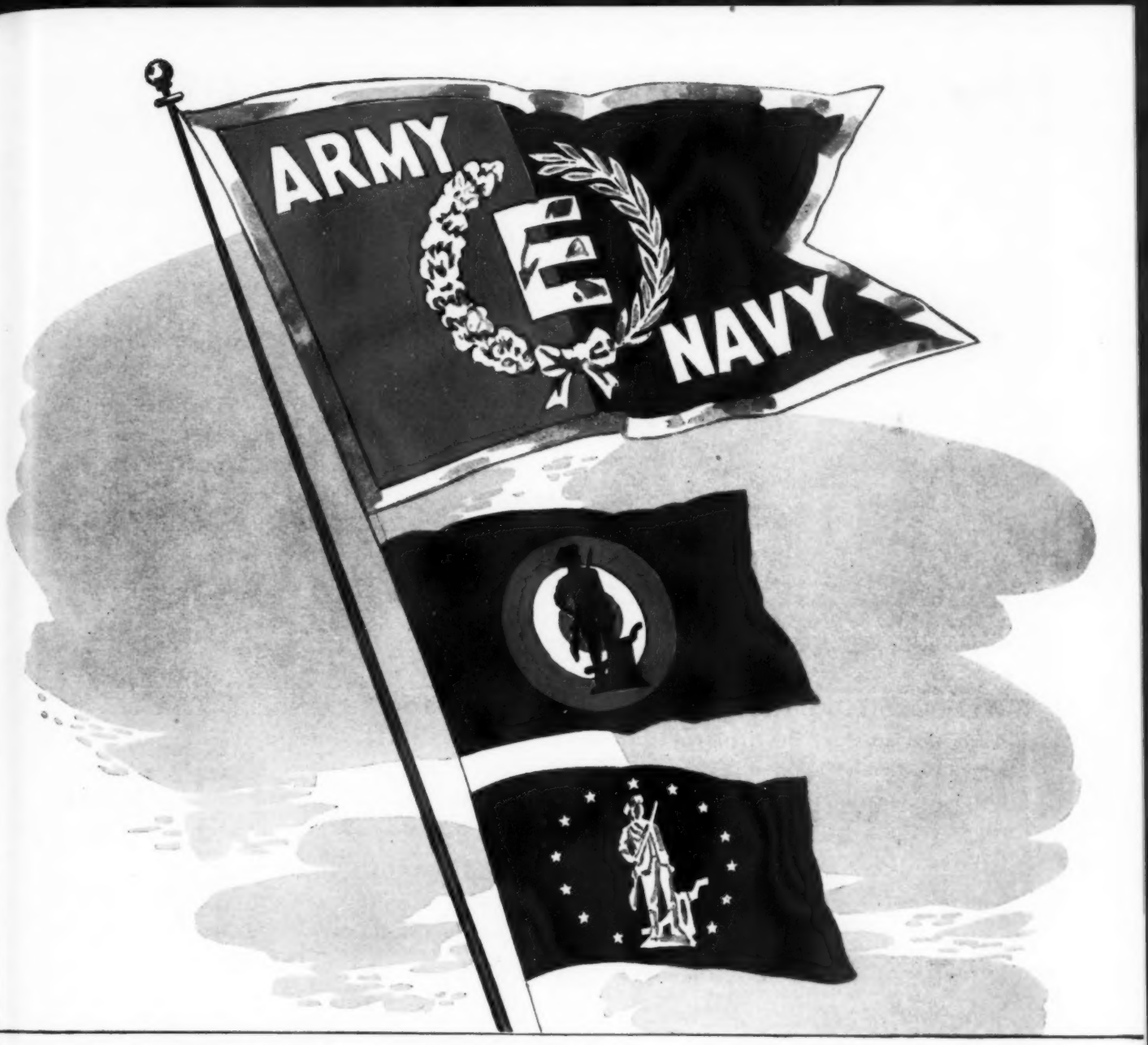
The cam enables our boys to "get the drop" on enemy airmen; shoot them out of the sky without danger of riddling one's own wing or tail surfaces. No thicker than a cardboard, they *have* to be delicately machined. Naturally, production of them was slow and costly—until the ordnance maker "turned to Turchan."

You, too, can increase your production — save time, money and reject worries by "turning to Turchan," the all-hydraulic duplicator. Turchans, you know, can be attached to any standard lathe, planer, shaper, grinder or mill. And they'll pay for themselves a thousandfold. Write today for our catalog.

TURCHAN FOLLOWER MACHINE COMPANY

Originators of Hydraulic Duplicating

8251 Livernois Avenue **Detroit, Michigan**



FORMED WHEEL GRINDING

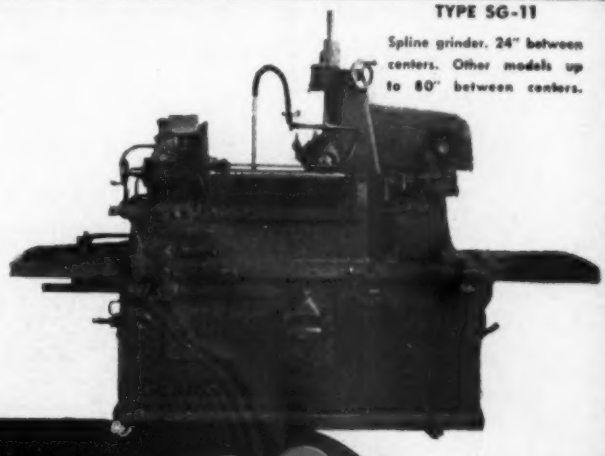
For "high achievement in the production of war materiel", the men and women of GEARGRIND have received the highest recognition given by our armed forces. All four GEARGRIND factories are delivering constantly increasing volume of vital machinery and parts.

GEARGRIND Machines, for the Formed Wheel Grinding of external and internal gears, external and internal involute splines, straight splines, serrations and racks.

RZEPPA Constant Velocity Universal Joints used in America's jeeps, multiple wheel drive trucks and other military vehicles.

GEAR TRAINS, for directing the Navy's Bofors anti-aircraft guns.

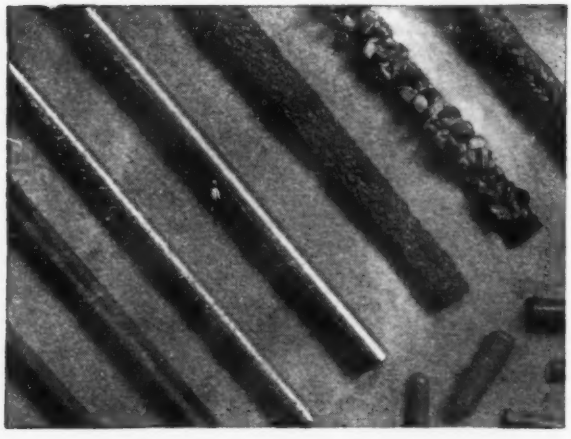
CONTRACT GRINDING for manufacturers of war materiel requiring extreme tooth accuracy and high finish.



TYPE SG-11

Spline grinder. 24" between centers. Other models up to 80" between centers.

HAYNES STELLITE RODS—*For Every Type of Hard-Facing Application*



Available in most sizes and types for essential uses

What Hard-Facing Is—Hard-facing is the process of welding on to wearing parts a protective coating, edge, or point of a hard metal. This procedure makes critical parts of machines and equipment last from 2 to 25 times longer. Haynes Stellite Company has a rod for every type of hard-facing application.

Types of Rod Available

Haynes Stellite Rod—the original non-ferrous cobalt-chromium-tungsten hard-facing alloy — available in three different grades — high in "red hardness," highly resistant to abrasion and corrosion—applied by oxy-acetylene or electric-arc process.

Hascrome Rod — iron-base hard-facing rod containing chromium and manganese — work-hardens under impact — applied by oxy-acetylene or electric-arc process.

Haynes Stellite "93" Rod—iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients—hard and abrasion-resistant—applied by oxy-acetylene or electric-arc process.

Haystellite Inserts — cast tungsten carbide in 13 standard shapes and sizes — extremely resistant to abrasion — generally applied by oxy-acetylene process with high-strength steel rod as binder.

Haystellite Tube Rod — tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant —applied as hard-facing rod, generally by oxy-acetylene process.

Haystellite Composite Rod — tungsten carbide grains of 4 standard screen sizes distributed in high-strength steel binder — extremely wear-resistant — applied as hard-facing rod, generally by oxy-acetylene process.

Write for descriptive literature on the types of hard-facing materials in which you are interested.

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

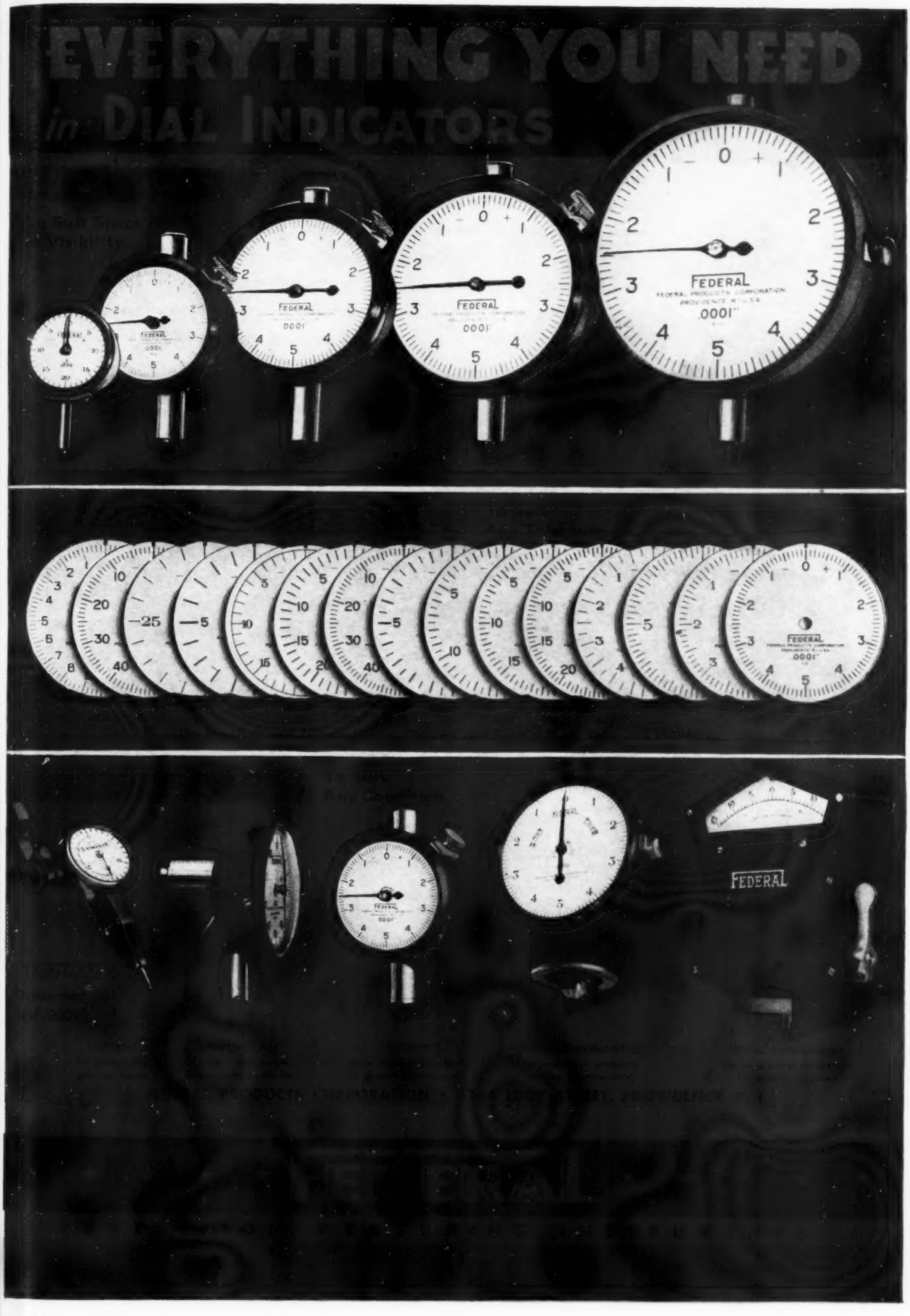
Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite" are registered trade-marks of Haynes Stellite Company.


EVERYTHING YOU NEED
in DIAL INDICATORS
FEDERAL
.0001"
FEDERAL

FOR LOWER UNIT COST ON SMALL PARTS PRODUCTION

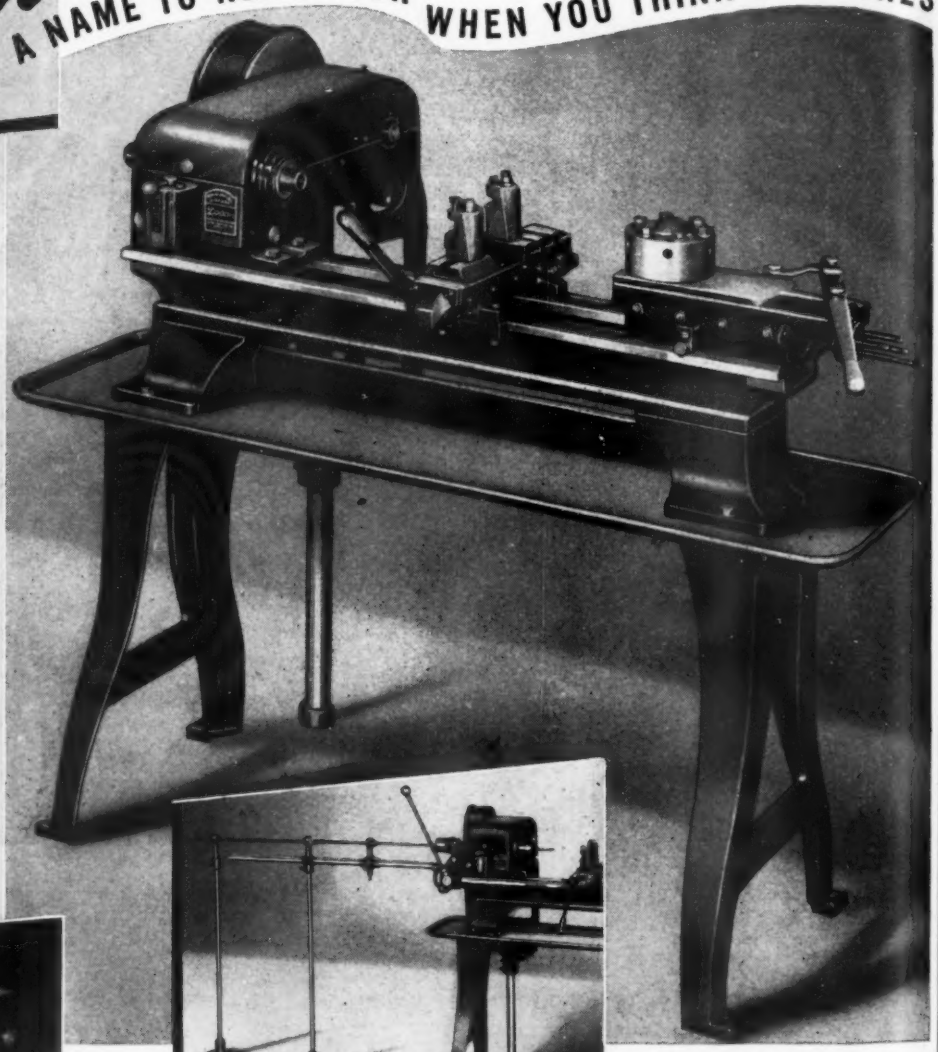
Urgent war needs have stepped up the demand for small parts to such an unprecedented degree that large turret lathes are being tied up when they are sorely needed for heavier work. The Logan No. 830 Hand Screw Machine was developed to break this bottleneck. Engineered and built to exacting specifications, it is capable of accurate, continuous production. With a capacity of 5/8-inch round bar stock, it turns out parts with the same speed and precision as that of the larger machines. And, because its cost is low by comparison, unit production costs are further lowered.

Logan

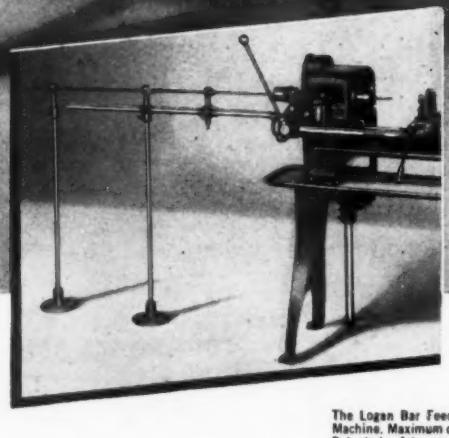
A NAME TO REMEMBER WHEN YOU THINK OF LATHES

SPECIFICATIONS

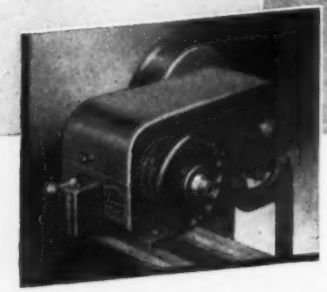
1. Swing Over Bed, 10"
2. Bed Length, 43 1/8"
3. Spindle Hole, 25/32" Capacity, 5/8"
4. Preloaded Precision Ball Bearing Spindle Mounting
5. 12 Spindle Speeds, 30 to 1450 R.P.M.
6. Cross Slide Stroke, 3 1/4"
7. Six Position, Automatic Indexing Turret
8. Stroke of Turret, 4 1/4"



NO. 830 LOGAN 5/8" CAPACITY HAND SCREW MACHINE



The Logan Bar Feed is offered as an accessory for the No. 830 Hand Screw Machine. Maximum capacity: 5/8" round bar stock. Maximum stroke: 2 inches. Patented safety cam action operates bar feed and locks collet at one operation.



The Logan Speed Collet Chuck is made to fit the No. 830 Turret Lathe, or other lathes with a 1 3/5" x 8 thread spindle nose. Capacity: 5/8" round work. Positive, accurate squeeze grip operated by hand wheel. No keys or wrenches.

LOGAN ENGINEERING COMPANY • Chicago, Illinois

MACKLIN GRINDING WHEELS

HELPFUL HINTS

and

Safety Suggestions

YOU MEAN YOU SHOULD TRUE THE WHEEL ALWAYS TRUE FROM THE CENTER?
When using diamonds for the truing operation, always start from center and work to corners. This is done as a precautionary measure, as the corners wear to a slightly smaller diameter, .001" per pass should be sufficient.
HEY! DONT TRY TO REMOVE ALL THE STOCK IN ONE PASS
Operators are often tempted to remove too much stock in one pass on the work. This causes the grinding wheel to break down too quickly, resulting in uneven wear and unsatisfactory finish.
21

GET YOUR COPIES OF THIS FREE BOOK

Many of the larger as well as the smaller users of grinding wheels have found this 64 page booklet so valuable that they have requested as many as 100 copies for distribution through their grinding departments.

Comments with requests for additional copies have been highly enthusiastic on the instructive value of the contents.

Already in its second printing, this illustrated booklet contains *Know How* facts invaluable as an aid in the operation and care of grinding wheels, and particularly for the instruction of new grinder hands. Do not hesitate to call on us for an adequate number of copies to cover your needs.

★

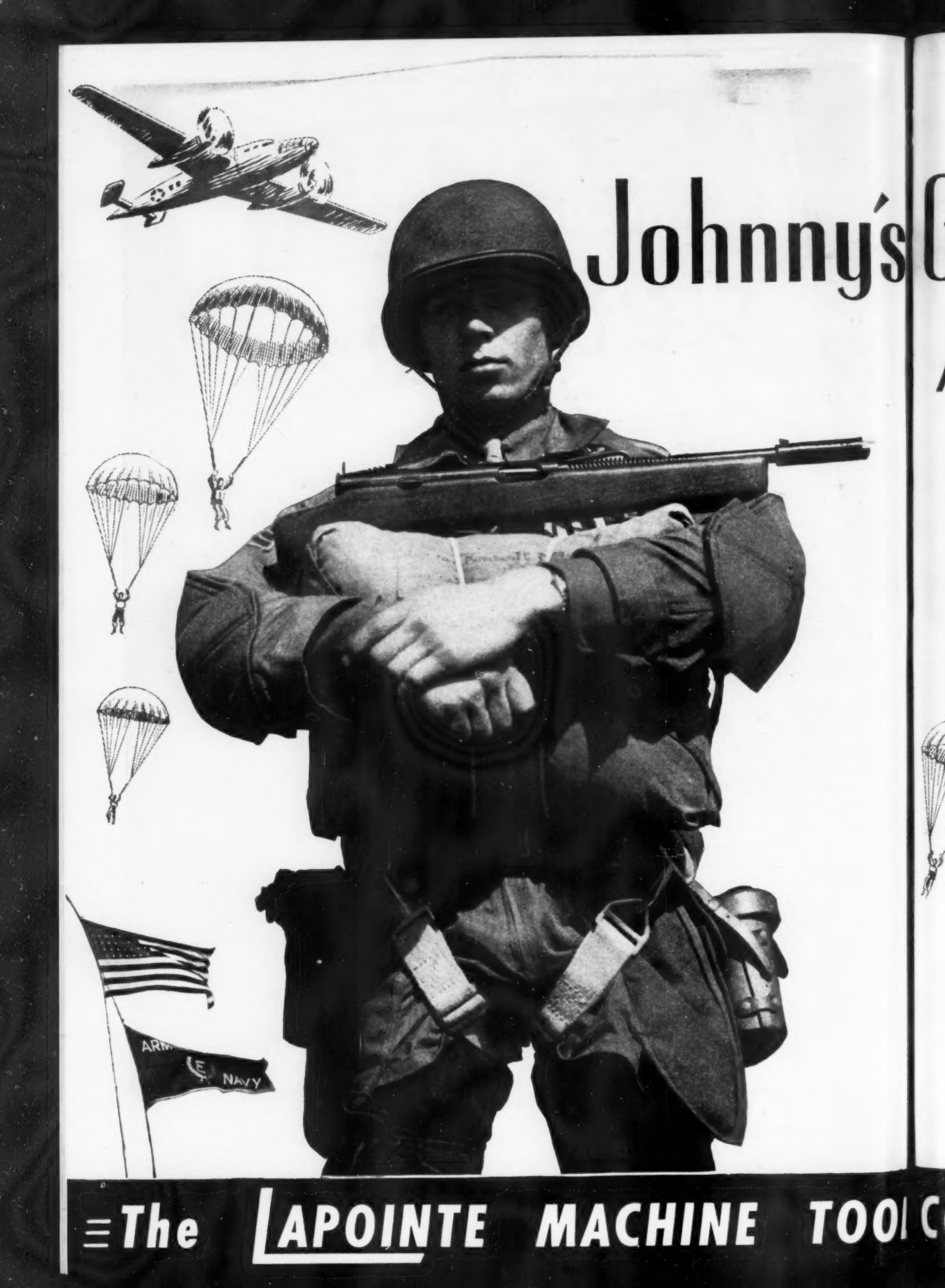
INVEST IN WAR BONDS

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia


Johnny's
NAVY
The LAPOINTE MACHINE TOOL

's Got a Gun...

That's putting Tojo on the run!

Thanks to U.S.M.C. and the 3 P's*

It's the Reising Gun that's playing hob with the Rising Sun. Harrington & Richardson Arms Company of Worcester, Mass. is making this six and a half pound bit of lethal dynamite capable of shooting 500 shots a minute.

In spite of its simplicity of design and its ultimate effectiveness, this new sub-machine gun could have proved a production bottle-neck, for cutting rifling grooves used to be a slow mechanical headache. Now, thanks to the 3P's – Primary, Production, Precision* – The Lapointe broaching method, this is done with only one trip of a broach through the barrel, a matter of seconds instead of minutes.

Primary, Production, Precision* is broaching today. Now one single high speed precision operation mass produces hundreds of jobs that were formerly done by many antiquated machining operations.

For Primary Production Precision consult Lapointe Broaching Method

O| COMPANY HUDSON, MASSACHUSETTS ★

MODEL B WET TOOL GRINDER "Blount"

A sturdy NEW machine for today's needs for fine tool grinding . . . . . .

This new Model B Wet Grinder is recommended for the grinding of flat face tools, such as planer tools, chisels both for wood working and metal working, and others requiring no curvature of grinding surface. With two wheels of different grades, rough grinding and finish grinding of tools can be accomplished.

Outstanding features include:

heavily constructed column enclosing an ample, easy-to-get-at coolant tank and sludge pan
water pan of generous capacity
motor driven, ball-bearing centrifugal coolant pump
spindles of high carbon steel running in deep-grooved ball bearings
grinding rest of exclusive Blount design, incorporating coolant ejector, which keeps tools cooler and cleans wheel while grinding
motor totally enclosed with manually operated switch and overload protection
magnetic starter or foot treadle switch available at extra cost if desired
grinding wheels, ring type with steel back, quickly interchangeable

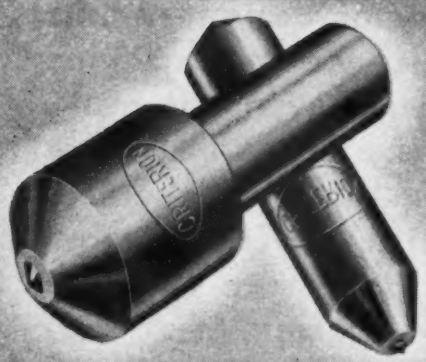
Send for Bulletin No. A8 giving complete detailed information.

GENERAL SPECIFICATIONS

Base of column—22" x 19½"
Base to spindle—37½"
Base to pan—33"
Motor—2 HP
Wheels—ring type steel back 12" dia. 3" height 2" face
Pan Width—22"
Pan Depth—4½"
Spindle speed—1750 RPM
Net weight—912 lbs. approx.
Gross weight—982 lbs. approx.

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*

CRITERION *Diamond* TOOLS



For **STEADY PRODUCTION**

Dependable diamond tools are vital in present production schedules. Every day more users are turning to Criterion Diamond Tools for the kind of service which they must have. Quality of diamonds used plus a unique method of setting assures extreme rigidity and extra tool life. Special tools made to order following blueprints or specifications. Sharp-pointed, selected thread grinding tools. Order direct. Request free literature.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

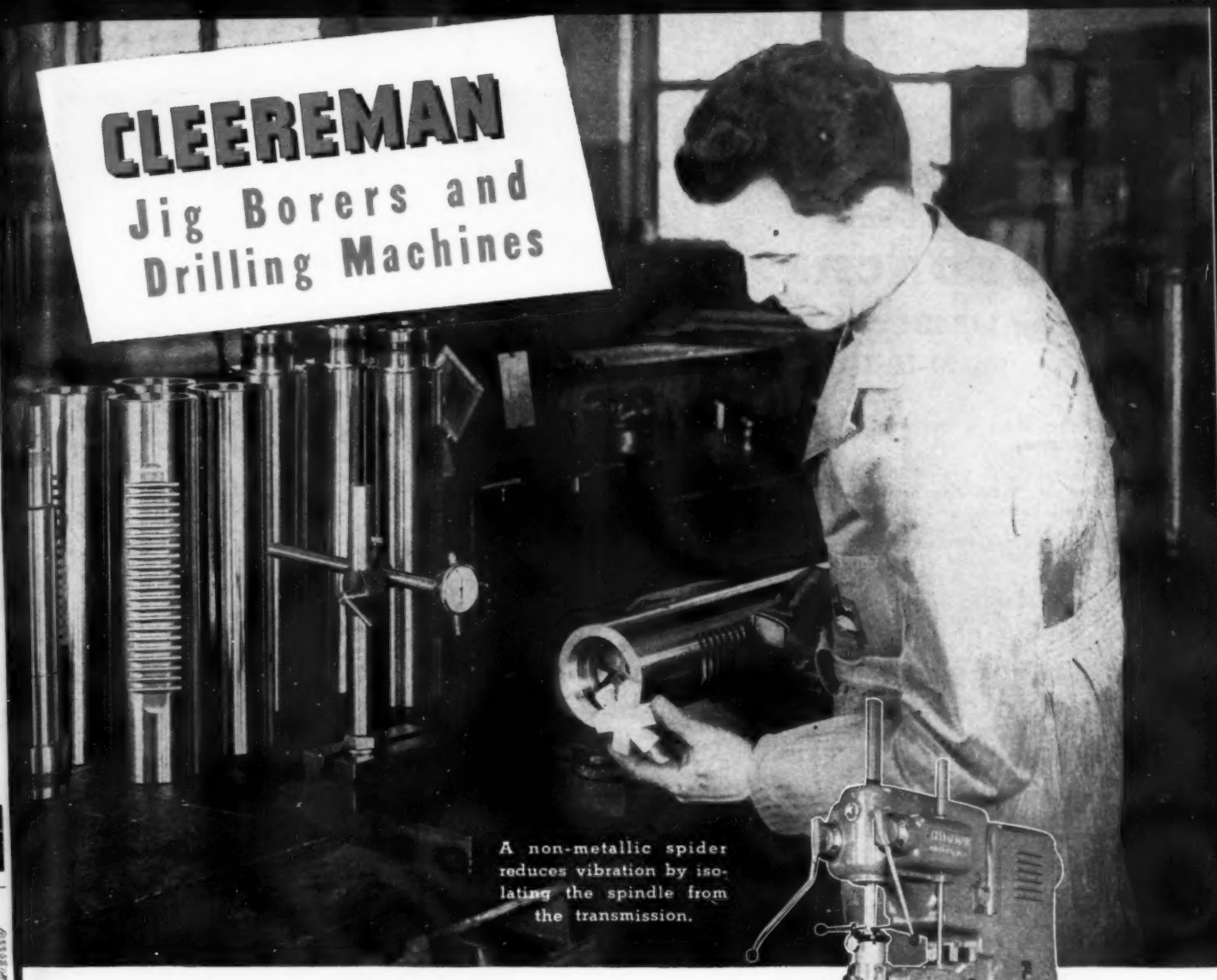
YOU CAN'T GIVE DUST THE BRUSH-OFF

A couple of strokes with the whiskbroom solves the problem of dust for the "ump"—but the whiskbroom treatment won't work in the shop. Here grinders and buffers send a stream of abrasive grit to attack expensive machinery and workers' lungs.

Throw a third strike past this deadly enemy of smooth production with The Cincinnati Air Master. Trap grit and dust at their source. Easy to install, easy to clean and supplied in three sizes to fit all grinders and buffers. Write today for detailed information.

The Cincinnati
ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS
The Cincinnati Electrical Tool Co.
DIVISION OF THE R. K. LE BLOND MACHINE TOOL CO., CINCINNATI, OHIO
2676 MADISON RD.

CLEEREMAN
Jig Borers and Drilling Machines



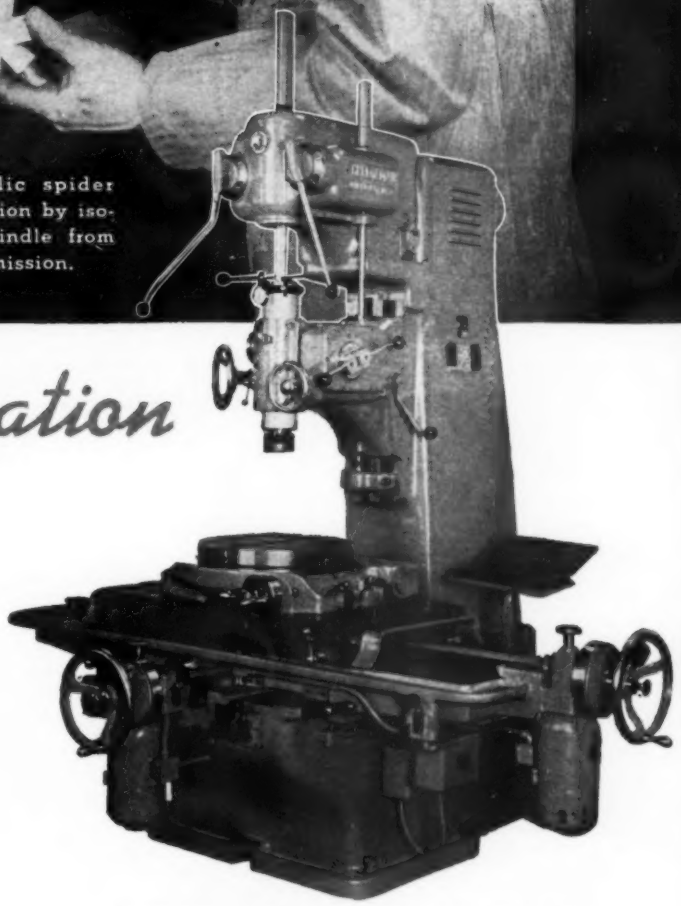
A non-metallic spider reduces vibration by isolating the spindle from the transmission.

Freedom from Vibration

. . . a feature which contributes to the extreme precision of Cleereman Jig Borers!

Write today for the new *Cleereman* Jig Borer and Drilling Machine catalogs!

ARMY E NAVY



A *Cleereman* Jig borer equipped with micrometer head stop, rotary table, and power rapid traverse to table and carriage.

BRYANT MACHINERY & ENGINEERING COMPANY

Associated with **CLEEREMAN MACHINE TOOL COMPANY**

General Sales Offices 400 W. Madison St. • • Chicago • Ill. • U.S.A.

NOW Your Surface Grinder

Can Sharpen

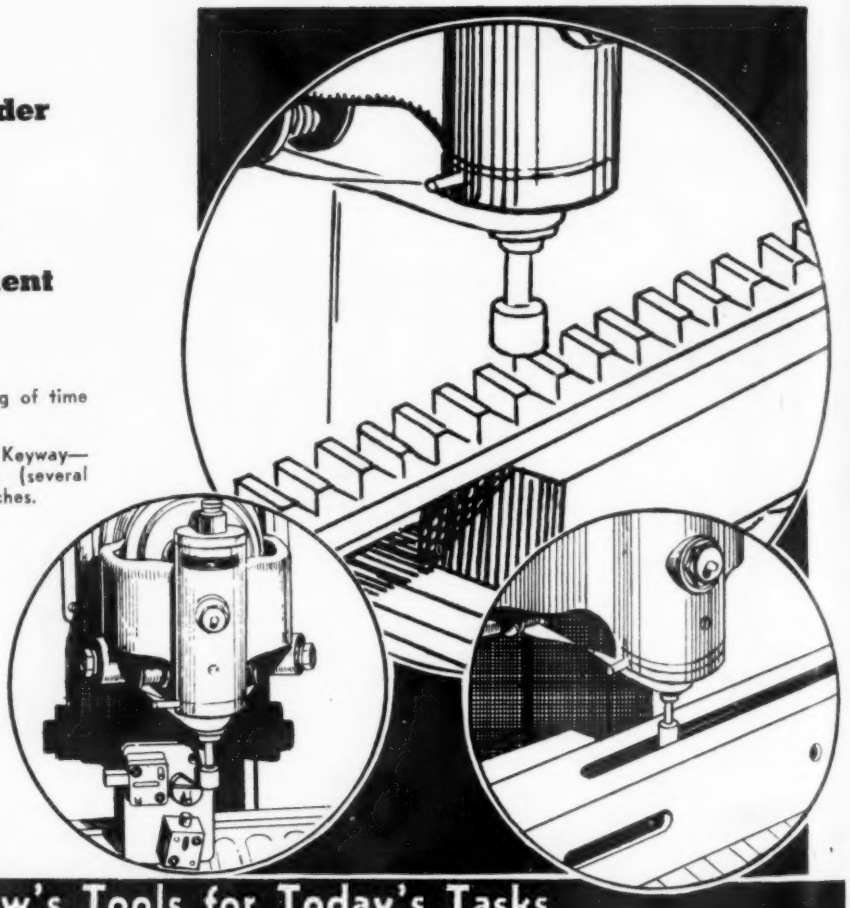
BROACHES

Using LIBERTY Attachment

No. 90–11 Vertical

- Sharpen them in your shop at a real saving of time and money.
- Liberty does a perfect sharpening job on Keyway—Straight Tooth—Angular Tooth Progressive (several types) Rectangular—Square and other broaches.
- Is quickly and easily attached to many well known makes of surface grinders. Saves up to 30 minutes in set-up time.

Write for Descriptive Literature And Price List



LIBERTY

TOOL & GAGE WORKS, INC.

241 Georgia Ave., Providence, R. I.

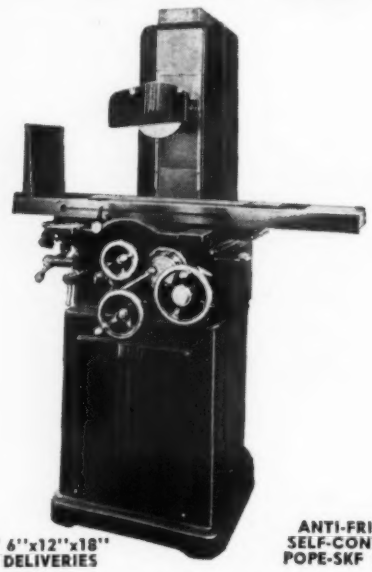
DESIGNERS AND BUILDERS OF PRECISION TOOLS—GAGES—SPECIAL MACHINERY

Tomorrow's Tools for Today's Tasks

ATLANTIC

No. 2 Automatic Precision

SURFACE GRINDER

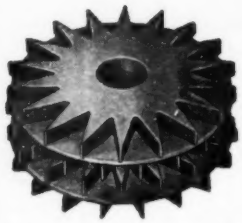


CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
POPE-SKF SPINDLE

ATLANTIC MACHINERY CORP.

149 Broadway New York, N. Y.



DESMOND

GRINDING WHEEL DRESSERS & CUTTERS

We manufacture a complete line of wheel truing tools and can supply the proper dresser for each of your grinding wheels.

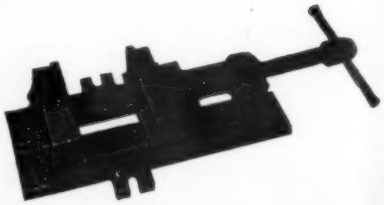
SIMPLEX

Steel Slide

VISES

A full line of Machinists, Welders, Filers, Production and Drill Press & Milling Machine Vises with solid steel slides.

Write for copy of catalog "A" and name of your nearest dealer who can supply you.



THE DESMOND-STEPHAN MFG. CO.

URBANA, OHIO

A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

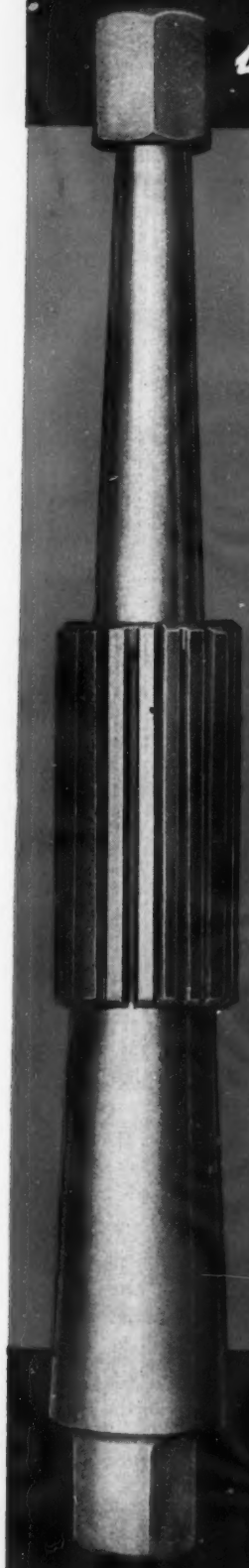
NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2⅛"	2¼"	2½"	2⅝"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44" x 60"	60" x 80"	60" x 80"	60" x 108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

Let Them Pay for Themselves in Two Jobs



YES!
KNOCK-OUT EXPANDING MANDRELS

will pay for themselves by the time each has been used on its second job for which special solid arbors would otherwise have been made.

K-O Expanding Mandrels are made of high quality steel, hardened and ground, and accuracy of less than .001" is maintained for the life of the mandrel. Size ranges will accommodate work from ⅜" to 5½". K-O Mandrels can be purchased singly or in convenient sets with metal boxes.

•

Write or wire for Bulletin M42AM

KNOCK-OUT

K. O. LEE CO.
ABERDEEN, S. D.

FLATNESS and SMOOTHNESS of Production Parts

The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.

Ultra-Lap MACHINE COMPANY
207 McDOUGALL AVE. • DETROIT, MICH.

BLADES FOR CENTERLESS GRINDERS . . . TIPPED WITH TUNGSTEN CARBIDE

Assure Greater Production and Accuracy in the finish grinding of bullet cores, armor-piercing shot, shells, projectiles, tank parts, aircraft engine parts, rifle and machine gun parts.

TALIDE

METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

We'll Keep the "Wheels of Industry" Coming, MAJOR!

STERLING'S workers - men and women - firmly believe that grinding wheels are the most important product for hastening industrial victory. Picture conditions in your plant if grinding wheels were unobtainable! There could be but few parts for the weapons our servicemen need . . . production would be regulated by antiquated grinding methods . . . we would lose the war!

That's why we tell our armed forces that we will keep the "Wheels of Industry" coming . . . because every plant, mill, and factory devoted to producing materials of war needs Sterling Grinding Wheels . . . quickly! That's why we all are doing our level best to get out the grinding wheels as rapidly as possible.

For toolroom grinding Sterling offers Sterlith Grinding Wheels in all necessary sizes, shapes, grains, structures and bonds. A wheel to do your work better . . faster!

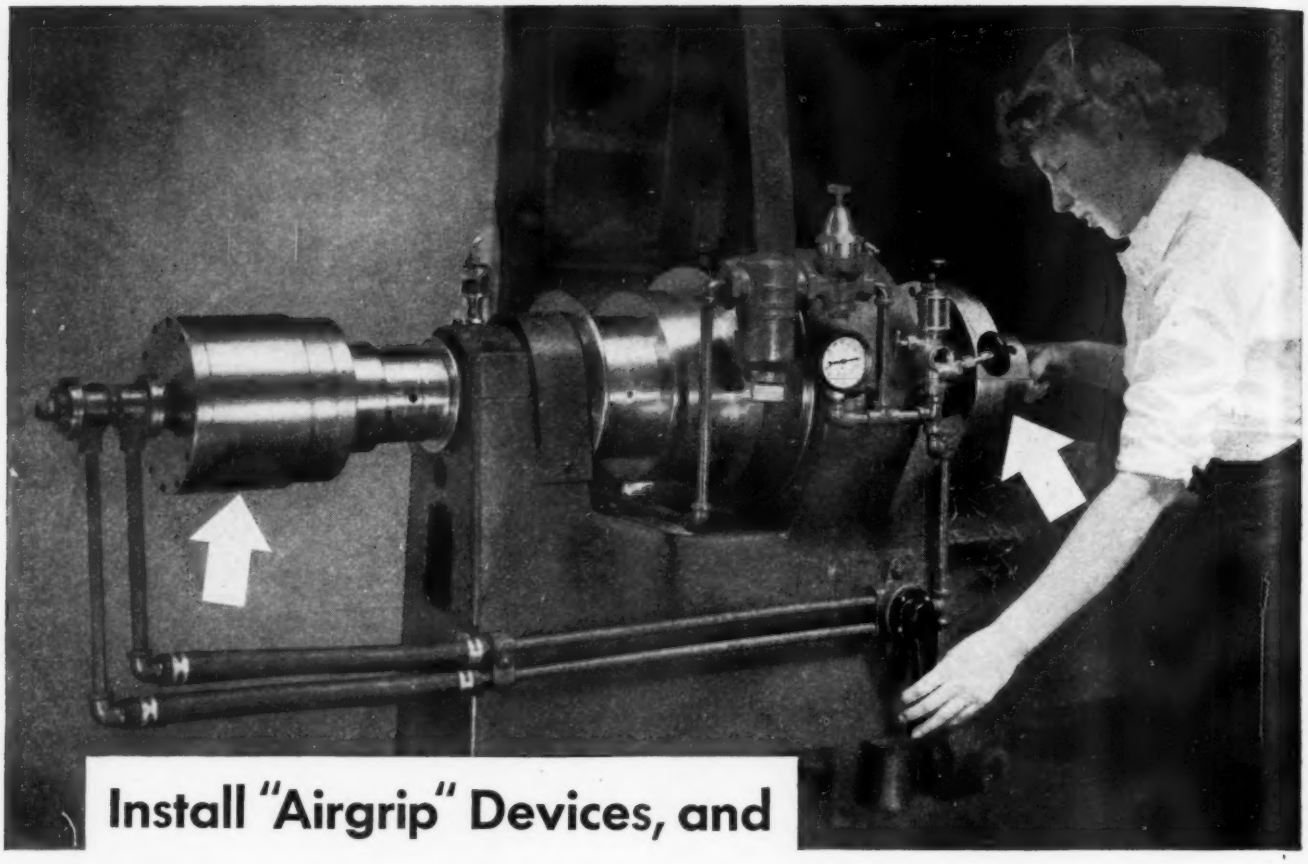
When victory is finally won, the grinding wheel industry will have done it's share. Daily, our laboratories are working on developments to meet all out-of-the-ordinary conditions being imposed upon industry. Daily, recommendations are being made and wheels produced to do the unusual jobs you want done. When the problems of peace arise, you will find grinding wheels continuing to do their part to make our country great.

Whatever your plans are for war or peace, it will pay you to consult with a Sterling engineer. Several new Sterling wheels have been introduced recently that may be just the solution of one or more of your troublesome problems! Write today!

• STERLING ABRASIVES •

THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY



Install "Airgrip" Devices, and

She'll beat Bill's output by 25%, or more

This is the old "strong-man," time-wasting, operator-tiring, high-unit-cost way of holding parts. Hour after hour the operator wrestles with a wrench—sapping his energy, increasing scrap, holding back production, and wasting critical machine hours.

Yes, she can take Bill's place and beat his best production record by 25%, or more, when you install "Airgrip" Holding Devices. They are available now, and installation is simple and fast.

She will quickly learn to use "Airgrip" Devices, producing at the full capacity of the machine—a thing Bill never could do with all his bulging muscles. And, because "Airgrip" Devices are so easy to operate, she will work a full turn and have output on schedule when the whistle blows.

It will pay you to investigate the advantages of "Airgrip" Holding Devices—increased production of 25% or more, lower cost per piece part, reduced spoilage, minimum operator fatigue.

"Airgrip" engineers are ready to help you on any problem where air can be used for fixtures or chucking purposes.

Anker-Holth Mfg. Co.

"Airgrip" Chuck Division

332 So. Michigan Ave. Chicago, Illinois

Jessop ...
High Speed Tool Steels

For High Speed War Production!

★ Consult the Jessop Representative regarding applications and availability of Jessop Quality Tool Steels.

JESSOP STEEL COMPANY

HEAD OFFICE AND WORKS

WASHINGTON . . . PENNA.

ARMY NAVY

ESTABLISHED 1901

A CENTURY PLANT *puts teeth in our War Machine*

THE gear getting the going-over in the picture will soon be part of a high-powered aircraft engine. And that engine will run smoother, perform better and last longer because this gear and all other fast-moving parts had brief but thorough contact with a century plant.

The tough, hardy fibers of a species of century plant are used in Osborn Fascut Tampico Brushing Wheels. A special chemical treatment enables them to hold abrasives better, cut faster, last longer and prevents "knifing" and "flutter". Because of it they can penetrate every recess and cranny of a part for high-speed mechanisms,

—polishing and blending the surface;
—removing scratches and tool marks;
—rounding corners, forming radii;
—exposing minute defects.

Thus they eliminate the imperfections that frequently become centers of stress concentration, and causes of failure.

Perhaps your own plant faces just such problems. If it does, remember that Osborn Brushing Specialists are on the job in every section of the country, ready and able to help war plants with the burring,cleaning and finishing problems that so often hold back production. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER
OF BRUSHES FOR INDUSTRY

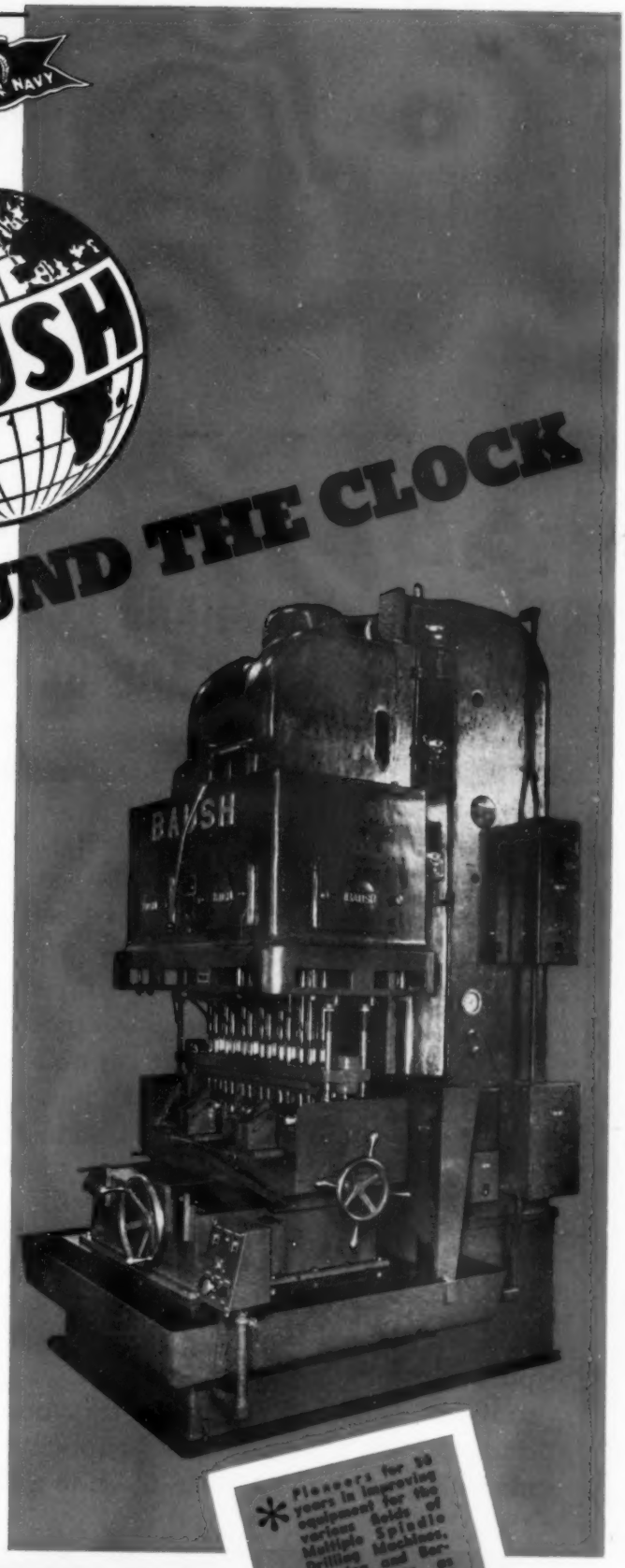
50 YEARS PIONEERING

BAUSH IS BUSY AROUND THE CLOCK

The Baush plant is busy day and night because Baush pioneering * developments in machine tool designs make the use of these machines of outstanding advantage and importance when applied to war production.

Men plus machines have made possible the honor conferred on Baush as symbolized by the Army-Navy "E" flag flying over our plant to which has been added another star on Feb. 6, 1943.

Twenty-four hours a day is the pace at Baush because the longer we work now the shorter the time to ultimate Victory and Peace.



* Pioneers for 50 years in improving equipment for the various fields of Multiple Spindle Drilling Machines, Tapping and Boring Machines, as well as special equipment.

BAUSH MACHINE TOOL CO.

Springfield, Mass. · Detroit, Mich.

ABRASIVE
No. 1½ HAND FEED SURFACE GRINDER

WORKING FOR VICTORY WOMEN in ever-increasing numbers, are taking the place of men in wartime industry. Many have become proficient operators of the Abrasive No. 1½ . . . and have done so in a remarkably short time. On the production line or in the tool room, its easy operation, convenient controls and dependable precision permit them to turn out maximum production with a minimum of fatigue.

The Abrasive No. 1½ gives a fine finish and is particularly suited for the most accurate type of flat, form, and gage grinding. It is designed to handle work of many shapes and sizes . . . particularly short-run jobs which do not warrant the bother of adjusting automatic feeds and stops. It has an unusual capacity, accommodating work 15" long x 10" wide x 12" high.

Built-in motor, integral with head

Hand feeds, few moving parts: No belts, no chains, no sprockets

Large handwheels, conveniently located

Vertical adjustment, rapid and sensitive

Bearing surfaces easily lubricated

The No. 1½ Grinder illustrated and the Abrasive power feed grinders — Nos. 3B and M-3 with horizontal spindles and No. 34 with vertical spindle — are described in Sweet's Catalog, or in more detail in separate bulletins available from dealers or the factory.

ABRASIVE MACHINE TOOL CO.

Dealers in Principal Cities

EAST PROVIDENCE · · RHODE ISLAND

THIS Elmes press is versatile. It can either exert its full force quickly . . . "Step on it like an elephant" . . . or press gently and slowly. Available in many capacities, this unit has wide application as a general purpose straightening, forming, forcing and bending press. It has controlled speeds, a rapid advance and adjustable stroke control. It is streamlined in design, compact, rugged and fully enclosed.

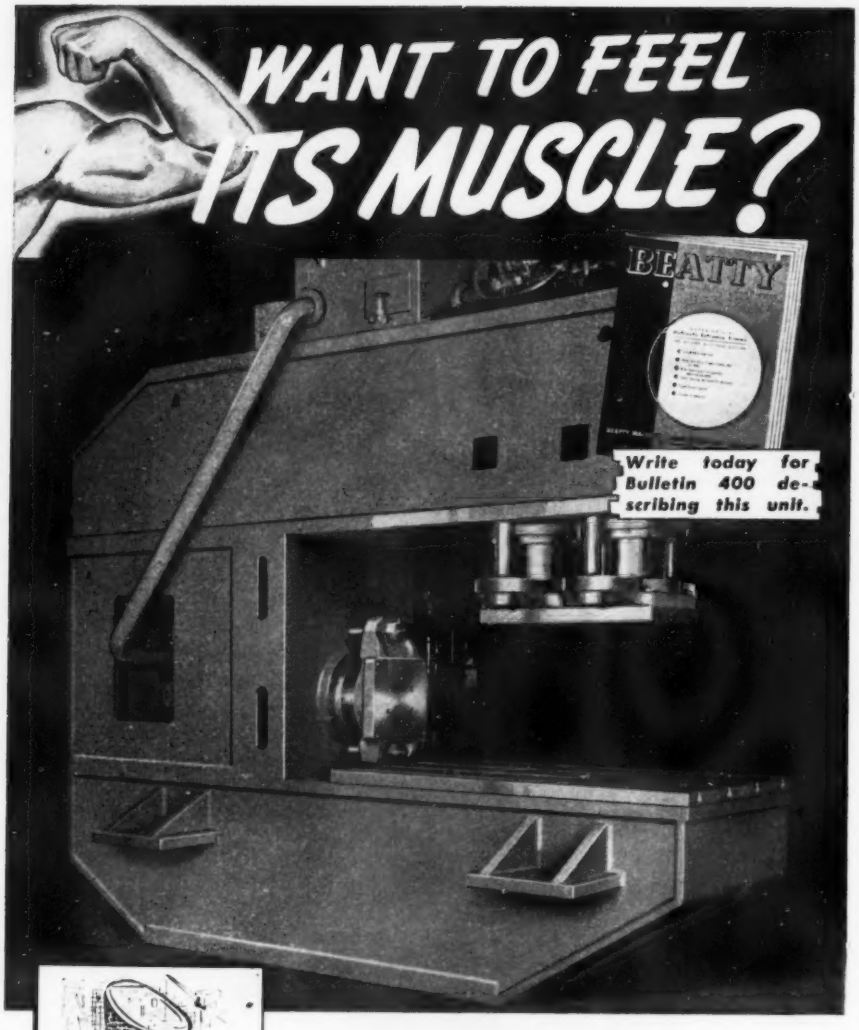
Elmes also manufactures metal working presses, plastic molding presses, extrusion presses, pumps, accumulators, valves and accessories. Furthermore, Elmes engineers are experienced in planning and laying out complete hydraulic installations to meet specific needs. They will cheerfully study your problems and make recommendations.

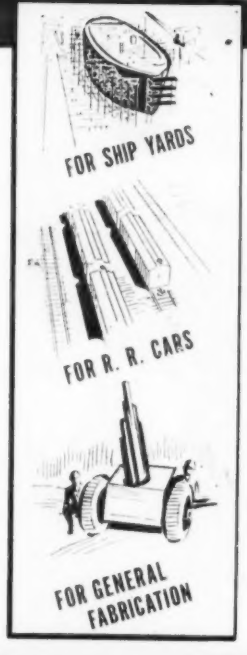
SINCE 1851
Elmes
HAYMARKET 0696

ELMES ENGINEERING WORKS
OF
AMERICAN STEEL FOUNDRIES
1601 FULTON ST. • CHICAGO, ILLINOIS

Also Manufactured in Canada:
WILLIAMS & WILSON, Ltd., Montreal & Toronto—*Distributors in Central and Eastern Canada* . . . . GORDON RUSSELL, Ltd., Vancouver—*Distributors in Western Canada*

METAL WORKING PRESSES • PLASTIC MOULDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES





400 TON FORMING AND FLANGING PRESS

A completely modern unit — fast, powerful and adaptable. Built to stand 24-hour production. Equipped with a unique type pump and valve design that eliminates the need for cooling coils with their inherent threat of water entering the oil supply line. If you fabricate heavy metal, investigate this and other machines in Beaty's complete line of punches, shears, coping machines, forcing presses, extruding presses, forming presses and bulldozers. One of these Beatty machines may be the answer to a production bottleneck. Write for complete information.

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

National CLASSIFIED ADVERTISING

for bringing business needs or opportunities to the attention of other men associated in executive management, sales and responsible technical, engineering and operating capacities with the industries served by . . .

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McGRAW-HILL PUBLISHING CO., INC.
330 W. 42nd Street
New York City

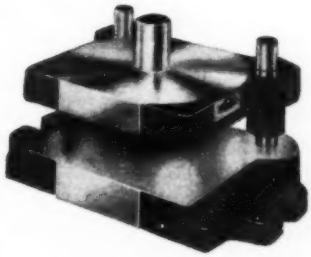
Here's to You, HIROHITO

Danly Machine Specialties, Inc. do not make hara-kari swords. We are, however, in the production line for a myriad of war materials.

We went to 3-shift operation in June of 1940. We did it for defense. We saw you coming, Hirohito, before Pearl Harbor. Danly Die Sets today are holding the dies that pound out plane parts, rifle parts, machine gun parts, tank parts, ship parts, submarine parts, parts for the defense of America and the defeat of the Axis.

Danly Weldments sail the sea, roll with the caissons, for your doom and defeat, Hirohito, and the doom and defeat of your partners.

You dared to challenge the American workman in his chosen field—Mass Production—and to threaten the security of his homeland.



DANLY DIE SETS

Welded Steel Fabrication

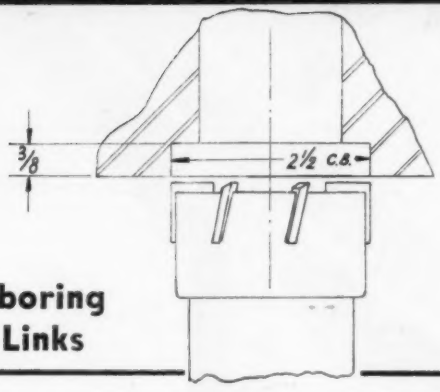
DANLY MACHINE SPECIALTIES, INC., *2100 So. 52nd Ave., Chicago, Illinois*

MILWAUKEE • DAYTON • ROCHESTER • LONG ISLAND CITY • DETROIT • CLEVELAND
PHILADELPHIA • • • • • • DUCOMMUN METALS & SUPPLY COMPANY, LOS ANGELES

HOEFER MILLING HEADS

Counterbore

24 . . . 2½" DIA. HOLES IN 7.8 SECONDS . . . . .



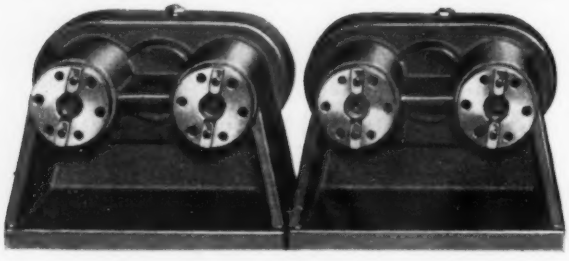
Counterboring Track Links

2½" dia. x ⅜" deep holes. Speed, 40' per minute—61 r.p.m.

6 tooth cutter cuts .048" per revolution

2.928' penetration per minute

⅜" depth—7.8 seconds actual machining time for both counterbores.



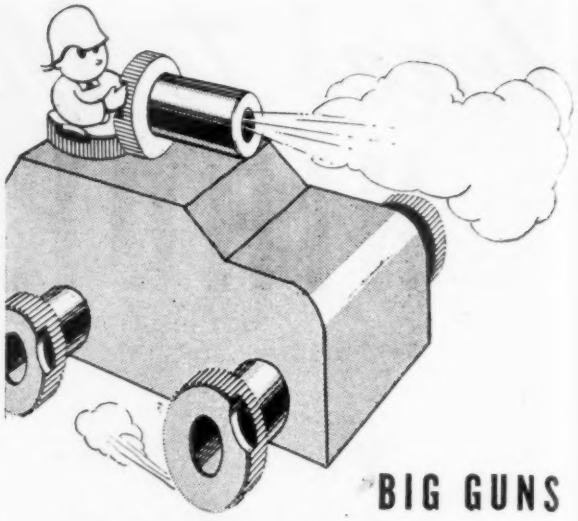
Two of a group of twelve two-spindle milling heads arranged for mounting of counterboring milling cutters, with standard key drive for counterboring Track Links. The spindle construction is that of standard milling machine type.

★ No matter how difficult your problem may seem to you, the chances are that we have furnished MULTIPLE SPINDLE Heads for similar use. Not only have we built heads for mounting on drill presses but also on rotating spindles and for mounting on the turret of turret lathes motivating them through the machine spindle containing the work.

Hoefer Heads not only increase production per hour but decrease cost of drilling or allied operations . . . also they increase production from the same floor space (no new machinery needed) and decrease handling time. Write and tell us of your needs and we will make recommendations.

HOEFER'S WHOLE BUSINESS IS HOLES

HOEFER MFG. CO. *Freeport, Ill.*



BIG GUNS FOR DRILLING HOLES

They're mighty small compared to a gun or a General Grant, but in building jigs for the manufacture of gun and tank parts or any other precision metal part it pays to use Universal Drill Bushings. Because of their straight and round superfinished bores, Universal Bushings save tools, wear longer and assure accuracy. Write for complete facts.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

ACROMARK

numbering, stamping and marking machines and accessories are extensively used where fast, accurate permanent work is a prerequisite.

THE ACROMARK CO. ELIZABETH NEW JERSEY

DIES *TAPS*

GEO MET RIC

Right from the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines

(Automatic and Semi-Automatic)

LELAND GIFFORD CO.
WORCESTER, MASS.

FRONT LINE Only "seasoned troops" will do in production's front line. At the workheads, where the production rate is determined, rely on tools that have proved their ability to stand up "under fire"!

MORSE

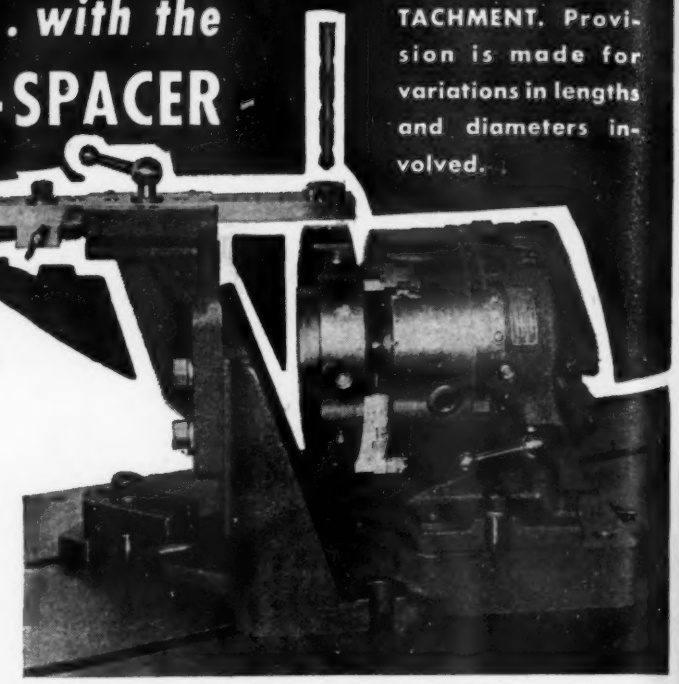
THERE IS A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY

NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

You'll get better, faster and more accurate indexing work . . . with the HARTFORD SUPER-SPACER



SUPER-SPACER with RADIAL DRILL ATTACHMENT. Provision is made for variations in lengths and diameters involved.

This simple, rapid, foolproof indexing device is proving its wide utility and value in busy tool rooms and shops in every branch of the metal working industry. It provides a means for securely holding indexing work and is applicable to millers, drilling machines, slotters, grinders, jig borers and planers.

Time of both set-up and indexing is reduced thereby saving flow-to-flow time. No special skill is required to handle the SUPER-SPACER because all chance of error is eliminated by mask plates.

Ability to use the HARTFORD SUPER-SPACER in either a horizontal or vertical position adapts it to a wide range of work. Furthermore it can be used to advantage on single piece work or for quantity production.

Scope of utility extends also to the speeding up of radial drilling, involving indexing, through the use of the HARTFORD RADIAL DRILL ATTACHMENT shown here. This device is easily secured to the SUPER-SPACER.

Investigate the possibilities of the HARTFORD SUPER-SPACER on your work by sending at once for complete details.

THE HARTFORD SPECIAL MACHINERY CO. HARTFORD, CONN.

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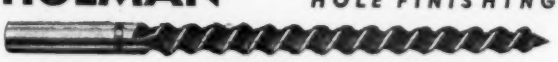
Carbide and Diamond-tipped
GAGES AND TOOLS
GUARANTEED QUALITY

ARTHUR A. *Crafts* COMPANY, INC.
Chicago 532 COMMONWEALTH AVE. *Detroit*
Boston

HOLMAN BETTER, FASTER HOLE FINISHING



HELICAL
TAPER PIN
REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

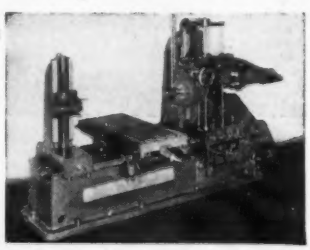
BARNESDRIL
HONERS . . . DRILLERS

Write Today for Catalog A

BARNES DRILL CO.
830 CHESTNUT STREET ROCKFORD, ILLINOIS

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

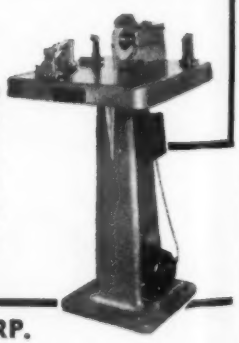
Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

CUTTER LIFE EXTENDED 5 to 8 TIMES
with the
BARNES *PRECISION*
CUTTER GRINDER



Highly efficient for grinding formed cutters, gangs of form or plain cutters, plain cutters, shank cutters, plain or tapered reamers; makes possible the use of profile ground formed cutters. No need to change existing cutter equipment. Form relieved cutters, sharpened on the "Barnes" become profile cutters. Quality and quantity of work produced greatly increased. Accuracy absolutely assured.

SEND FOR DESCRIPTIVE CIRCULAR

GENERAL MACHINERY CORP.
140 Federal St. Boston, Mass.

34.3% Saving in Machining Time

44 MINUTES SAVED ON PRODUCTION OF TANK PART

This aluminum Tank Drive Housing was formerly machined on a horizontal bar type machine. Operations include boring oil seals, chamfer bearing shoulders, bore for shoulders, and bore shoulder on oil seals. With the installation of W. F. and John Barnes two-way boring machine the time has been reduced from 128 to 84 minutes per part.

Cast-iron inserts in the aluminum Tank Drive Housing are bored simultaneously with the steel bearing caps. Two of the three bores on each side are of different diameters and are bored by inserting tool blocks into the boring bars after passing the bars through the housing. Direction of feed is reversed in boring these two diameters. Spindle heads are provided with three speeds.

BORE SIZE IS HELD TO ± .0005", while depths are held to ±.005" and ± .001" with a high degree of finish. The operations are identical on both sides of the housing and boring is done from two ends simultaneously.

This is another example of how W. F. and John Barnes special machines increase production. Perhaps you can save time in a similar way . . . our engineers will be glad to help.

Customer Improves Delivery by Designing and Building Fixture

This tank manufacturer used his own facilities to help speed delivery of his machine. While we manufactured the basic machine he designed and built an ingenious, yet simple fixture. If you have similar design and manufacturing capacity in your plant, and need quick machine delivery, our engineers will be pleased to work with you in a similar manner.

IS YOUR PRODUCT LISTED HERE?

If you are manufacturing any of the following products it may pay you to investigate the possibilities of W. F. and John Barnes Engineering Service in designing and building machines to suit your part and production.

Automobiles — Airplanes
Air Conditioning
Guns and Armaments
Pencil Sharpeners
R. R. Equipment
Pipe and Fittings
Tractors — Trucks
Washing Machines
Oil Drilling Equipment
Hydraulic Equipment

W.F.&JOHN BARNES

FREE PRODUCTION AND TOOLING IDEAS

Not a catalog, but a set of eight bulletins describing a better way to get better machines. Each bulletin traces a machining problem from the original study of the part to the final machine design. Each may suggest a tooling or production set-up that you can use today — valuable file information for tomorrow. Write for bulletins A-30 through A-38.

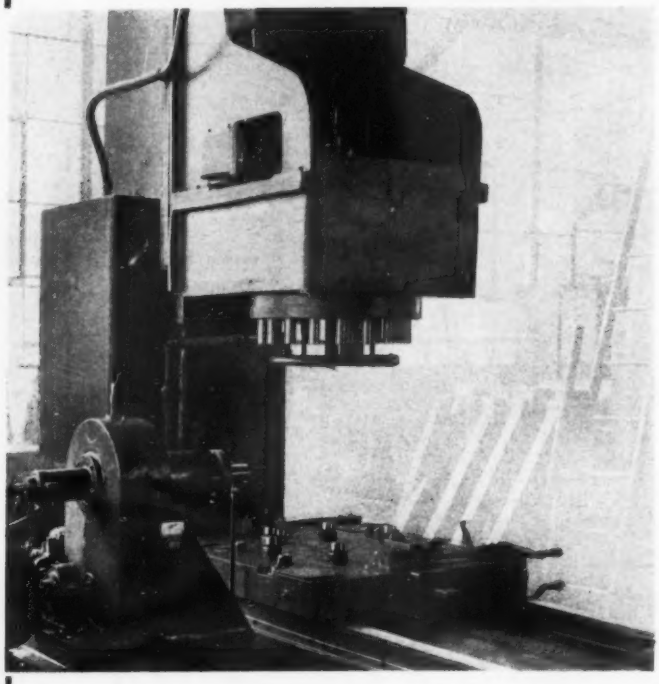
W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

Buhr PATENT

MULTIPLE SPINDLE PRODUCTION DRILL and TAP HEADS

convert any machine for present day needs



17-SPINDLE BURR TAPPING HEAD
Mounted on a vertical column and direct driven by motor. Circulating oil pump for positive lubrication and vertical adjustment in spindles for tap adjustment. Buhr single Spindle Horizontal Tapper mounted on a bracket and driven direct by motor.

BUHR MACHINE TOOL CO.

ANN ARBOR MICHIGAN

Specialists in Multiple Spindle Drilling. Boring, Reaming, and Tapping Equipment

"ROCKWELL"
HARDNESS TESTER

BETTER and BETTER
EACH YEAR
SINCE 1921

WILSON

MECHANICAL INSTRUMENT CO., INC.
Concord Ave. New York

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to **HELL**

Write for Circular!

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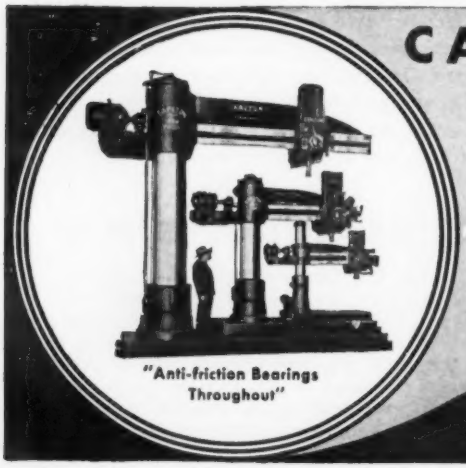


"Anti-friction Bearings Throughout"

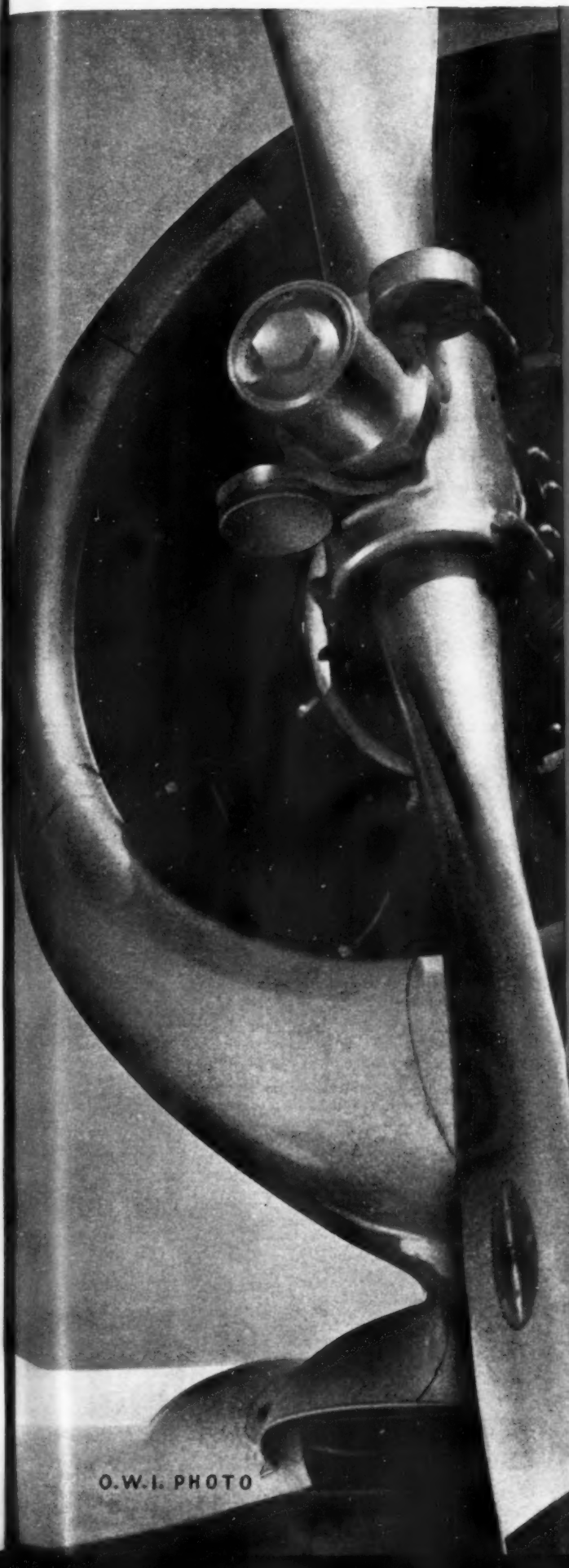
CARLTON RADIAL DRILL

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

NATIONAL STANDARD FOR WAR PRODUCTION



O.W.I. PHOTO

—THE MODERN HIGH-EFFICIENCY MACHINE TOOL

plus

THE FAMOUS

JACOBS CHUCK

THE JACOBS MANUFACTURING COMPANY
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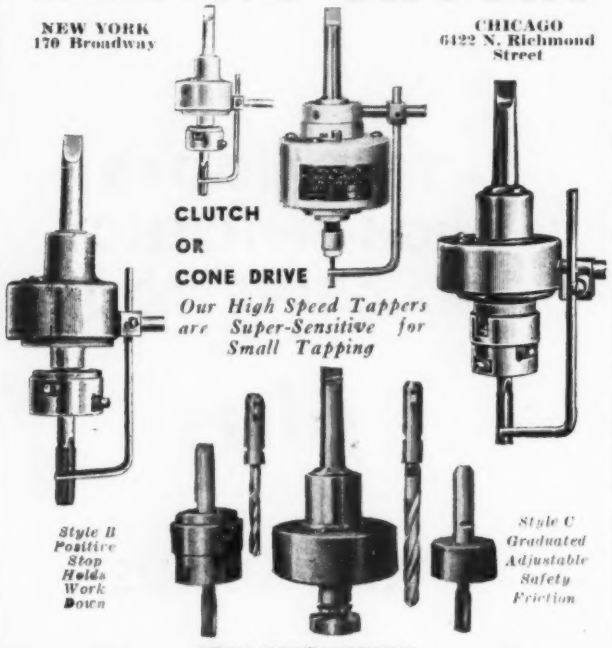
Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
170 Broadway

CHICAGO
6122 N. Richmond Street



CLUTCH
OR
CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

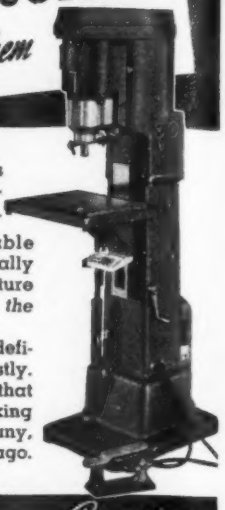
Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

NO TOLERANCE PROBLEM ON HASKINS

2 FEATURES

Insure Continuous, Trouble-Free TAPPING PRODUCTION

...and only Haskins has them



AIR OPERATION uniformly controls the accuracy of the work. Each part precision tapped *exactly* like every other.

PIECE-PART CONTROL, applicable on many jobs, makes tapping practically automatic. Placing the part in the fixture actuates a micro-switch and—*air does the rest.*

Tapping the Haskins way is faster, definitely more accurate, definitely less costly. Send for TAPPING TIPS—new literature that gives many money-saving, money-making ideas. R. G. Haskins Company, 2761 W. Flournoy Street, Chicago.

HASKINS

HASKINS *Precision* TAPPING EQUIPMENT

Almond Drill Chuck

The Original Manufacturers of Drill Chucks

The Almond Three-Jaw Drill Chucks were the first to be placed on the market. They were Pioneers in the field of Drill Chucks. For over seventy years Almond Chucks have formed a necessary part in the logical procedure of machine developments. Are made in types and sizes to fit all machine tools and portable drills.

Write for further information

T. R. ALMOND MFG. CO.
ASHBURNHAM, MASS., U. S. A.

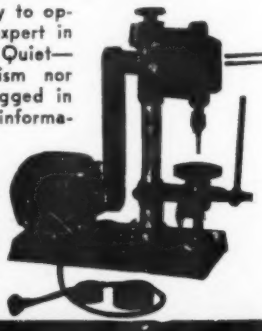
For Sensitive Tapping of Precision Work

HAMILTON-MUEHLMATT SENSITIVE TAPPING MACHINE

• Here's a high speed, sturdy little tapping machine which is especially adapted to precision tapping of light work. It is now being used very successfully for tapping parts for instruments, cameras, watches, clocks and business machines.

It has gained wide acceptance due to the high quality of work produced because of its particularly smooth operation without breakage of even the finest taps.

Mechanically simple and easy to operate, a man can become expert in an hour or so of operation. Quiet—no noisy reversing mechanism nor slinging of oil. Can be plugged in any light socket. For full information write for bulletin.



PERTINENT DATA

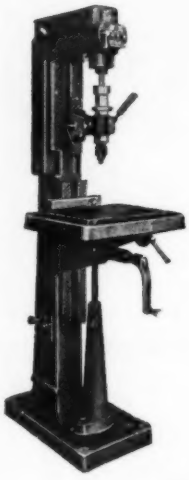
Capacity—From smallest and finest tap to 10-32 inclusive
Power—1/6 H.P. 1750 R.P.M. Motor either CI-AC or compound DC
Tapping speeds approx. 1200 to 2600 R.P.M.
Size of machine—16 in. x 7 in. x 22 in. high
Weight—Approx. 60 pounds

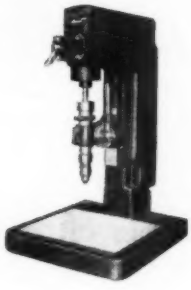
The Hamilton Tool Co.

830 NINTH ST HAMILTON, OHIO

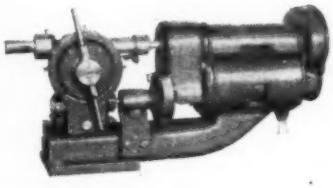
A HIGHLY DEVELOPED LINE...

Avey





MA 8—Eight speeds. 1200 to 12,000 R.P.M. Small work up to 3/8". Built-in motor. Bench and column types. 1 to 6 spindles.



Type B—No. 1, No. 2, No. 3 sizes. Hand feed drilling units. Hand feed tapping units. Power feed drilling units.

ONLY years of steady development can evolve the drilling equipment that is found in the Avey Line of Sensitive Drilling Machines.

The advances required in machining methods caused by the demands for greater output, necessitated more efficient drilling equipment. Avey Drilling Machines have steadily led the field.

Avey High Speed Sensitive Drilling Machines are built-in types and sizes to cope with varied needs. They are designed in capacities from the smallest drill gauge size to approximately 1¼ inches.

Being ball bearing throughout, they rate the highest speeds without vibration. This feature insures maintained accuracy.

The Avey Catolog details the line of Avey Drilling Machines and Drilling Machine Accessories.

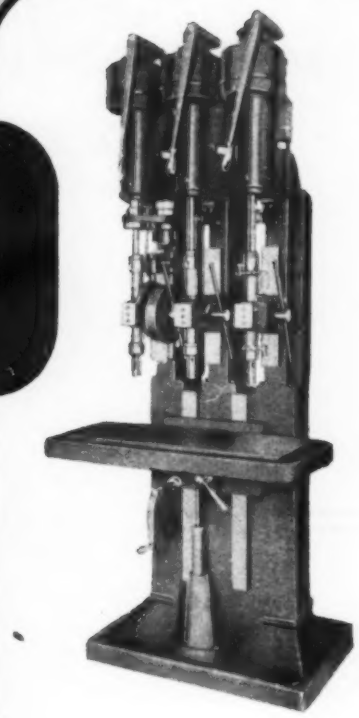
Avey Engineers will come to your aid in solving new and different drilling problems.

●

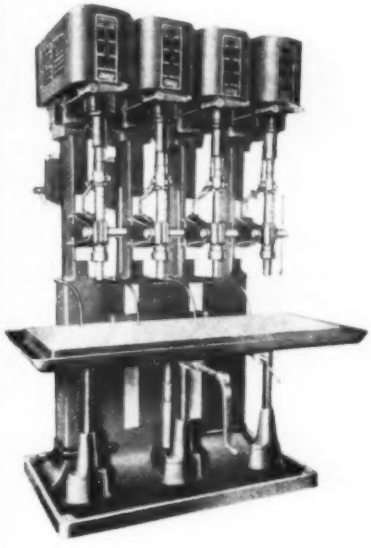
Individual Motors for each Spindle.

Single and Multiple Spindles.

AVEY
DRILLING MACHINE CO.
CINCINNATI · OHIO



MA 6—Six speeds. No. 2 and No. 3 sizes. Built-in motors.



Belted quick speed change machine. No. 2 size. Four speeds. Standard frame motors.

Avey DRILLING MACHINES
CINCINNATI · OHIO

Why Not Buy the Original Electric Etcher?

MARK IRON and STEEL

THE Etchograph WAY

3000 IN USE

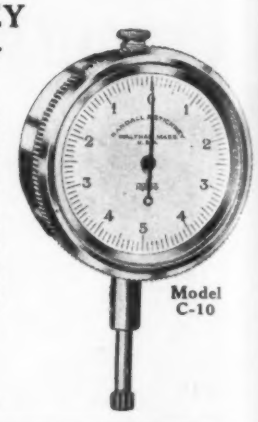
Mark parts in process, tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides—quickly—plainly.
Three sizes to meet all requirements.

Write for circular and prices

BREWSTER-SQUIRES & CO.
Hudson Terminal Bldg. New York, N. Y.

RANDALL & STICKNEY
New 1/10,000″ Indicator
Model C-10

Range	3″
Diameter of case	1 15/16″
Diameter over all	2½″
Depth of case	⅞″
Length over all	3½″
Lug or Bracket—Offset, on center if desired	Hole 3/16″
Back held in position by	4 large screws
Center of spindle to center of hole in lug	15/16″
Weight	8 ounces
Stem	9/32 diam.
Dial	0-5-0 or 0-10
Graduated	.0001
Crystal	Non-breakable

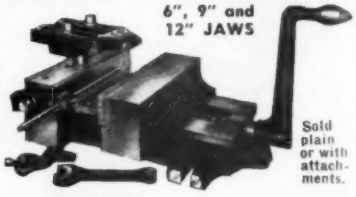


Model C-10

RANDALL & STICKNEY
Waltham, Mass., U. S. A.
Makers of Gauges Since 1885

GRAHAM MULTI-PURPOSE VISE

With special attachments and various special jaws, this vise serves many jig and fixtures needs, as well as plain holding jobs. Sizes for drill press, radial, miller, planer, shaper, grinder.



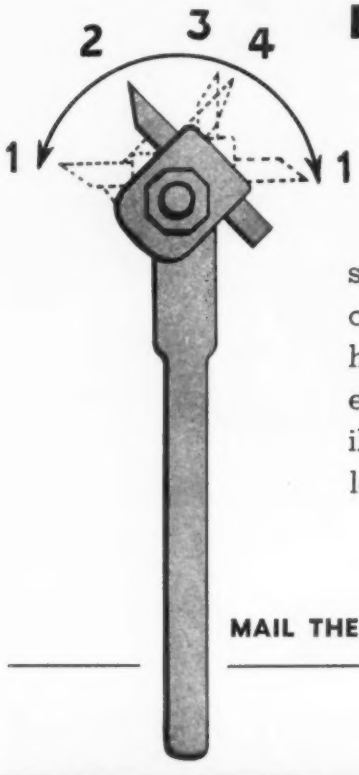
Sold plain or with attachments.

KNURL HOLDER FITTING LATHE TURRET

This tool will produce almost any type of knurling pattern, using only straight cut knurls. Takes work up to 2½″ dia.

Request Illustrated Price Circulars

GRAHAM MFG. CO. 87 BRIDGE STREET EAST GREENWICH, R. I.



EVERY AMERICAN TOOL HOLDER HOLDS

3 IN **4**

BIT SIZES **POSITIONS**

Each of the four sizes of American Tool Holders will hold three sizes of bits in four positions. This range meets all requirements of tool room lathes on light, precision cuts. American Holders have a wide, positive grip which prevents tool breakage and enhances the accuracy of the lathe itself. The line drawing illustrates the four positions—all available in a few seconds by loosening and tightening a single bolt.

MAIL THE COUPON TODAY

Please send complete information on the four standard sizes of American Tool Holders

Name ..... Title .....

Company .....

Street .....

City ..... State .....

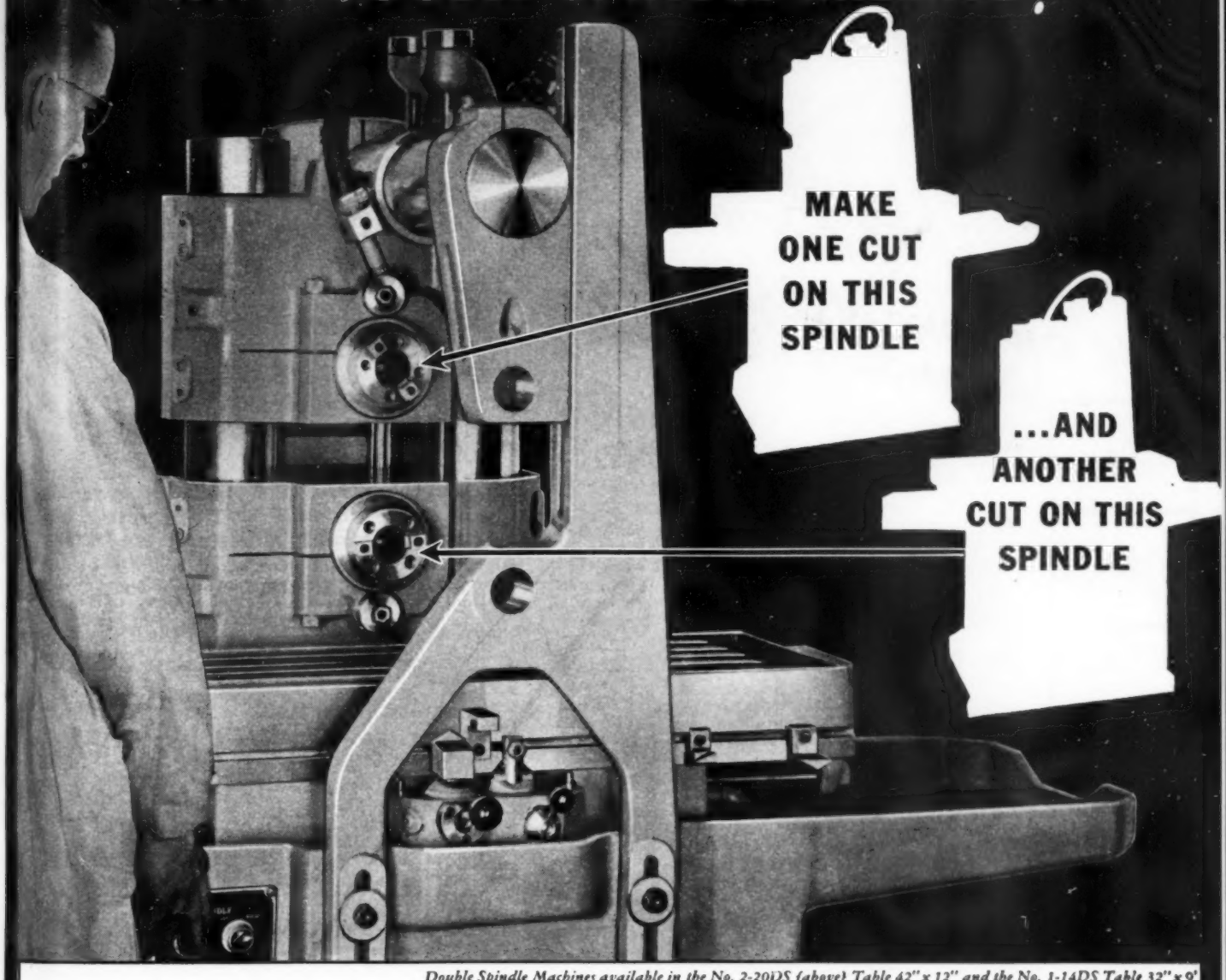
A.M.

EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES

One MACHINE DOES THE WORK OF *Two*

WITH DOUBLE SPINDLE MILLING!



Double Spindle Machines available in the No. 2-20DS (above) Table 42" x 12" and the No. 1-14DS Table 32" x 9'

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.
BUFFALO
Don W. Patterson
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DALLAS
Hamilton-Huster Machinery Co.
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F. W. Schiefer Machinery Company
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F. F. Barber Machinery Co.

● Manpower and machine-power do a double job . . . with Kent-Owens Double Spindle Milling Machines!

Typical operations for these machines include: (1) sawing or splitting full circle bearings into two parts; (2) face milling two parallel surfaces or milling two parallel slots at the same time; (3) milling gear, cutter, spline and ratchet teeth . . . milling two opposite teeth simultaneously.

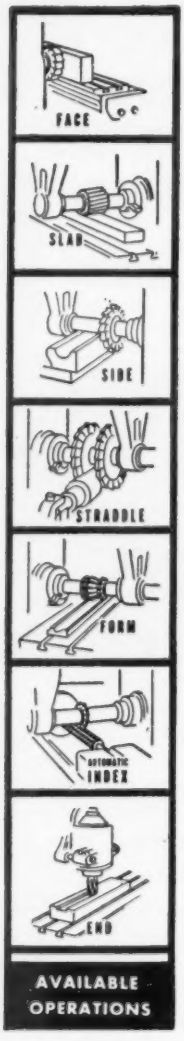
Thus, whenever the character of the work permits two cuts at the same time on the same piece, or the handling of two identical or different parts simultaneously, these machines will practically *double production!* Contact your nearest representative or write us. Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS *for Milling Machines*

FOR PRODUCTION MILLING OF SMALL PARTS

...IN STEEL, CAST IRON AND ALUMINUM

Use any one of three Standard Rigidmils



AVAILABLE OPERATIONS

(At Right) Illustration shows effectiveness of two-way table cycle. Operator merely changes work piece in fixture at end of table opposite from milling. Loading time is free.

ALL of these milling operations can be performed on practically all metals with Sundstrand Rigidmils. Three sizes are available and whether your work consists of short run jobs in various metals or long run production you can mill either way by merely selecting the machine large enough to handle all of your parts.

High Ratio Spindle Heads For All Metals . . .

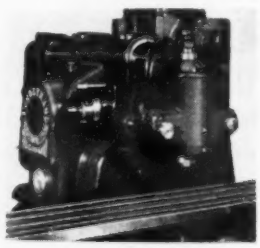
Each of the three standard Rigidmils is supplied with either one of two unusually large spindle speed ranges. Speeds for every milling job in any metal for all cutter sizes within range of the machine are easily obtained. See the specifications below for spindle speed ranges.

Wide Range of Hydraulic Feeds . . .

Infinitely adjustable hydraulic feeds together with the wide spindle speed range permit adjustment of both to obtain the best possible cutting condition and maximum production regardless of the metal being machined.

Vertical Spindle Heads

are available as extra equipment. These add further to the versatility of Sundstrand Rigidmils in handling a large range of set-ups.



(At Right) Vertical spindle-head available as extra equipment on No. 0 Rigidmils. Similar spindle-heads available for each of the three standard Rigidmils.

For Long or Short Run Milling Jobs . . .

High rapid traverse and quick acting controls reduce non-productive time on long run jobs. Simplicity of feed and speed adjustments together with ease of set-up and change-over enables Sundstrand Rigidmils to offer similar production advantage over general purpose equipment on short run work.

SUNDSTRAND ENGINEERS CAN HELP IN SELECTING MILLING EQUIPMENT

Let our engineers assist you in selecting the proper Rigidmil for your work. They will be glad to study and make recommendations on more productive methods or suggest changes which may increase production or lower cost. They are at your service without obligation. Use this service freely. Send complete accurate information with each inquiry.

FREE DATA

These interesting bulletins cover the Sundstrand No. 00, No. 0 and the No. 1 Rigidmils. Get the complete information on this versatile line of milling machines. Write for Bulletin No. 112.

MAKE A PRELIMINARY SELECTION FROM THESE BASIC SPECIFICATIONS →

These specifications cover the basic dimensions of the three smallest* Sundstrand Rigidmils. If your job requires a machine of different capacity or model send prints and production requirements for preliminary recommendations—no obligation.

SPECIFICATIONS	NUMBER 00	NUMBER 0	NUMBER 1
TABLE—Max. travel	8" Std.	18"	18"
Working surface of table	7½" x 25"	8" x 46"	10¾" x 46"
Top of table to spindle	9⅞" max., 1½" min.	13" max., 2½" min.	14½" max., 3¼" min.
Hydraulic feed range	½" to 37" per min.*	½" to 38" per min.*	½" to 31" per min.*
Hydraulic rapid traverse	400" per min.	325" per min.	345" per min.
SPINDLE—Nose	No. 40 N.M.T.B.A. Std.	No. 40 N.M.T.B.A. Std.	No. 40 N.M.T.B.A. Std.
Cross adj. of quill	1¾"	1¾"	1¾"
Vertical adj. of spindle	8⅜"	10½"	11¼"
SPINDLE SPEEDS (by pick-off gears)			
Type A	57 to 2416 r.p.m.	25 to 1200 r.p.m.	20 to 1200 r.p.m.
Type B	85 to 3600 r.p.m.	50 to 2400 r.p.m.	40 to 2400 r.p.m.
SPINDLE MOTOR—Foot Mtd.	¾ h.p., 3600 r.p.m.	1 h.p., 3600 r.p.m.	3 h.p., 1800 r.p.m.

** Larger sizes also available.*

* No. 00: Optional feed range—1¼" to 66" per minute. *No. 0: Optional feed range—1½" to 67" per minute. *No. 1: Optional feed range—1¼" to 55" per minute.

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND MACHINE TOOL CO.

2523 ELEVENTH ST., ROCKFORD, ILLINOIS, U. S. A.

FOREMOST IN Carbide Tool Development

The inclusion of Tantalum Carbide in the manufacture of Ramet Cemented Carbide Tools is the reason for their superiority. Tantalum Carbide is an extremely hard material and it imparts to hard carbide compositions a self-lubricating action which minimizes cratering or chip wear.

Ramet Standard Tools

are complete tools, ready to use, in a choice of 10 styles, 3 grades, and many sizes—164 tools in all. Ramet Carbide Tipped Standard Tools meet a majority of requirements for machining steel, cast iron, and all other materials, and are readily adaptable to special jobs.

Ramet Milled and Brazed Tools

have a Ramet Carbide Blank brazed in place. All grinding is done by customer. Any size or shape of shank or grade of blank is obtainable in this classification.

Ramet Tools to Order

cover any style or shape of tool made to customer's order. Ramet Cemented Carbide Blanks are brazed in position and tool finished, ground ready to use.

Ramet Blanks

Cemented Carbide of any shape, grade, or style all obtainable for the customer to make his own tools. A large variety of sizes in two styles and any of the three general purpose grades are available as standard blanks.

TANTUNG is a cast, hard, tough, non-ferrous alloy. Its red hardness is far above that of any steel. It is strong and tough and unlike other non-ferrous cutting alloys, Tantung contains Tantalum Carbide. Tantung is effective up to the carbide cutting range. Use Tantung where you cannot use carbide.

Ramet

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS · DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: CARBIDE TOOL AND DIE COMPANY, LTD., HAMILTON, ONTARIO

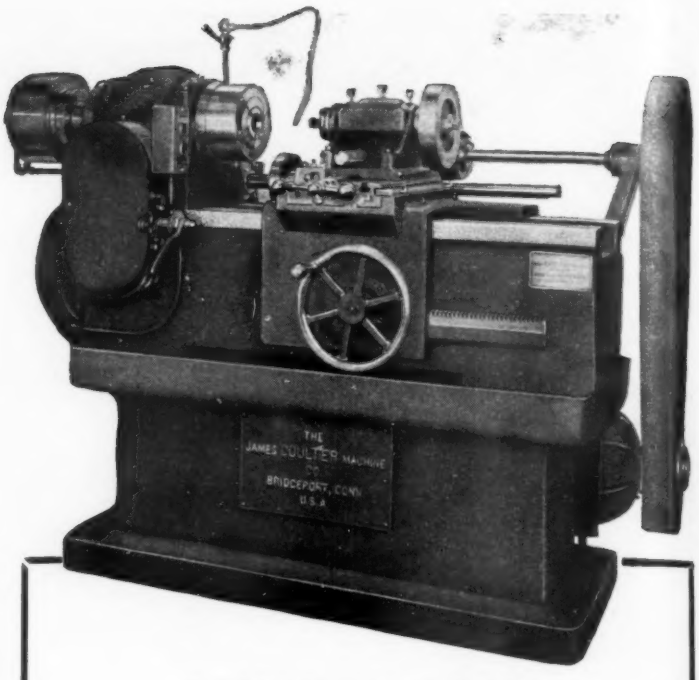
4315

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

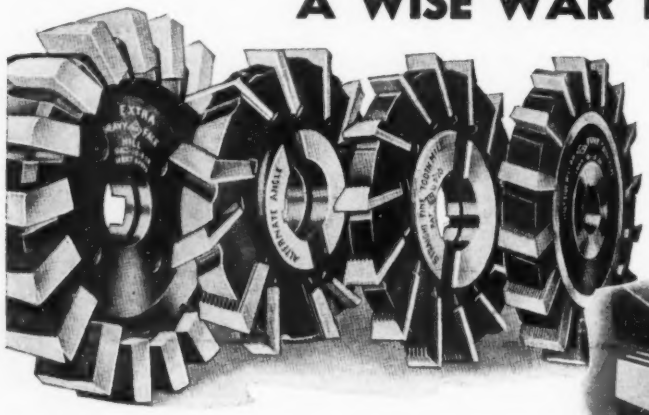
Maximum external thread, 7"; minimum hole depends on smallest hob practical.



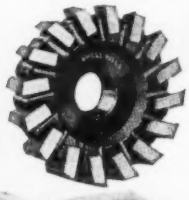
Send for Descriptive Bulletin giving full information.

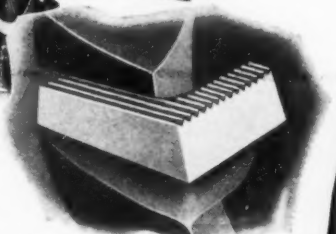
The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

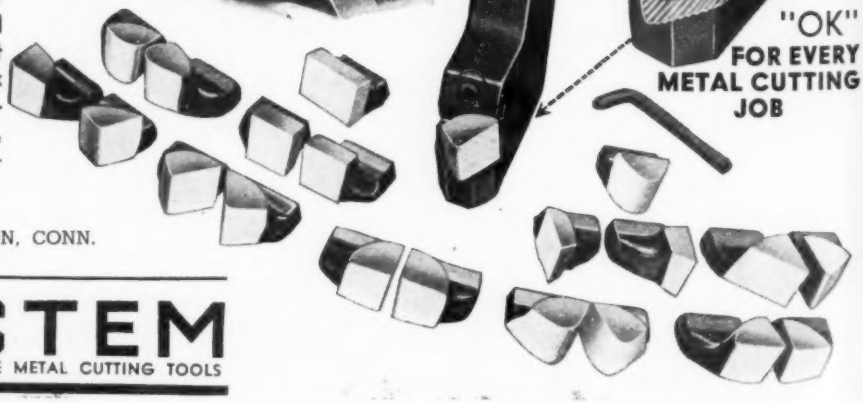
A WISE WAR TIME PURCHASE



A LONG-TERM PEACE TIME INVESTMENT







"OK" FOR EVERY METAL CUTTING JOB

Remember—these same OK Metal Cutting Tools you now find such a help in speeding up war work will be just as valuable in your post-war set-up. By then, your investment will just be getting under way! Their great flexibility of use will put them to work on any product you care to manufacture. Yes, O K Tools are best in war, best in peace, best wherever performance counts!

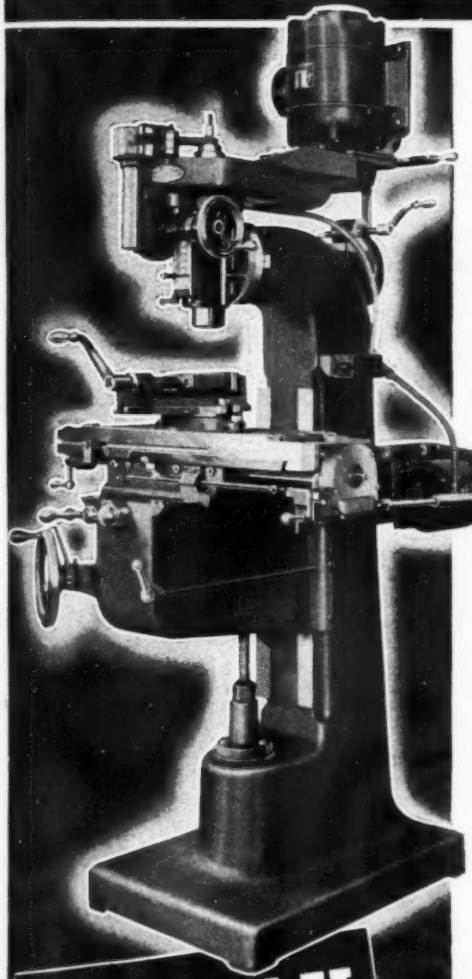
THE O K TOOL CO., SHELTON, CONN.

THE TRADE OK MARK **SYSTEM**
OF INSERTED-BLADE METAL CUTTING TOOLS

Accurate

AS THE GUNS THEY HELP PRODUCE

INDEX MILLS



Manufactured by Index Machine and Tool Co. Jackson, Michigan

CHECK THESE FEATURES!

★ Precision Ball Bearing Spindle that will require no attention for two years.

★ Swivel Head which can be set 90° right or left.

★ Super construction sensitive enough to do work with end mills ⅛" diameter yet rugged enough to use ¾" end mills taking full cuts 24 hours a day.

★ Verniers for locating, and power feed to spindle for boring.

★ A versatile machine that can be used in the tool room or on the production line.

Send inquiries for immediate quotation and quick delivery to Factory Sales and Distributing Agents.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICHIGAN

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

★

Good advertising speeds information from those who have it . . . to those who need it.

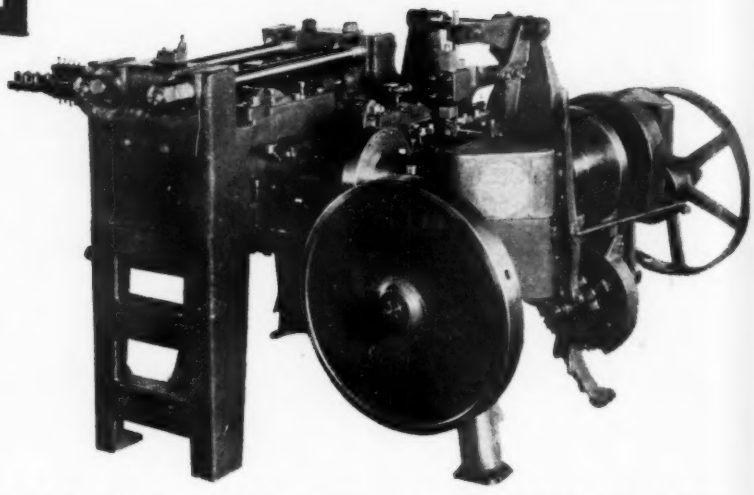
★

McGraw-Hill Publishing Company, Inc.

330 West 42nd Street New York

The New NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINES

for swaging, stamping, piercing, blanking, forming of coiled metal



These new machines built in two models—for general purpose, heavy duty fabricating metal forming—provides a capacity far beyond what is practical to accomplish with ordinary cam motion. The new NILSON is a combination power press and four slide machine with powerful silent action of main press slide operated by crank motion through toggle or knuckle joints. Great strength and rigidity are inherent in this machine. Die sets are readily accessible and easily removable. No obstruction to view is offered and tools can be adjusted without interference.

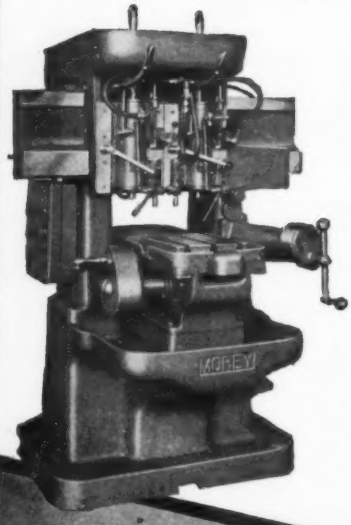
These machines are built in 2 sizes—for forming from 3/16" and ¼" diameter wire and for flat material 2" and 2½" wide. Send for 4-page bulletin giving complete details.

As specialists in the design and construction of special automatic machinery of all kinds, we are in position to render a complete service on this class of work. Consult Nilson on your special requirements.

THE A. H. NILSON MACHINE CO... Bridgeport, Conn., U.S.A.

MOREY DESIGNED AND BUILT For PRECISION Plus PRODUCTION

MOREY VERTICAL PROFILER AND MILLING MACHINE



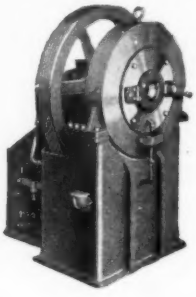
Over 2000 Morey Profilers in continuous service assuring speedy production for the United Nations in duplicating small parts.

Cross head is balanced on vibration-free cross rail . . . Clearance between spindle and table easily increased or decreased . . . Spindles mounted on precision bearings . . . Ball bearings throughout . . . Slides ride on scraped ways and are adjustable against future wear.

Ample provision for lubrication . . . Simple adjustment takes up backlash . . . No chatter marks on work . . . Table working surface, 12¾" x 15"

Ask for Circular No. 680A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.



THE
TORRINGTON
ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

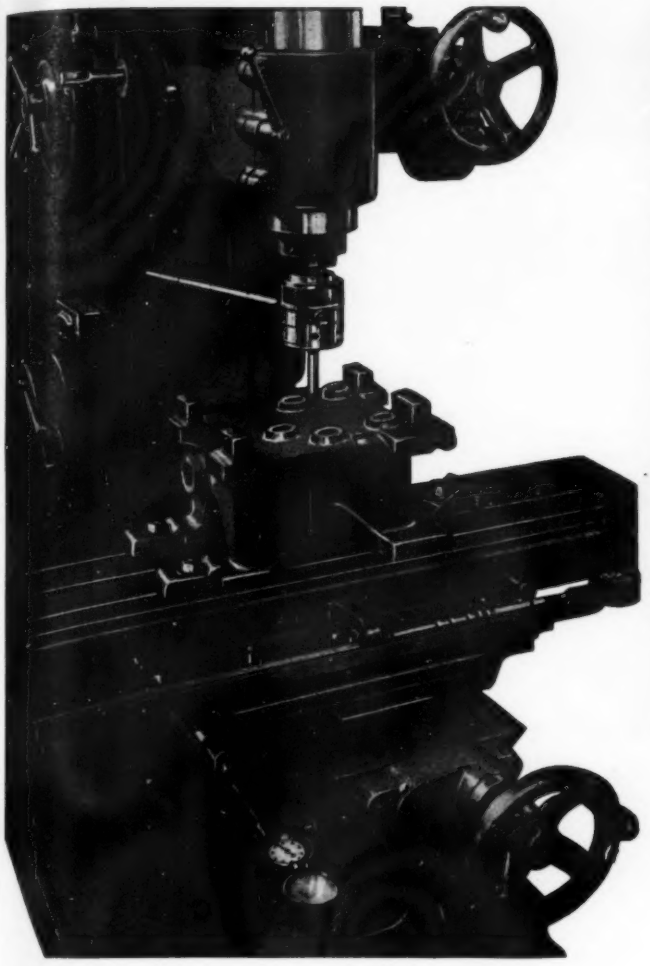
STRAIGHT SIDE SINGLE CRANK PRESSES
for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

Full details on request.

ZEH & HAHNEMANN CO.
180 Vanderpool Street
NEWARK N. J.



A typical jig boring job is done on a KNIGHT Miller. With dial indicators, all five holes were accurately located and bored. At the same setting, the corner pads were milled, insuring squareness with the bored holes.

- Internal and external milling is done at one setting
- Step milling is made easy by getting vertical adjustment on spindle
- Profiling, boring, and slot-milling is all done at one setting
- Precision boring is done, using dial indicators for accurate locating
- Rigid spindle makes possible deep end milling
- Jig boring is possible becauuse of dial indicators
- In experimental work you can machine many jobs completely on this one machine and handle difficult operations without special equipment
- For limited and special production you can keep costs down and maintain quality without special tooling

WRITE FOR NEW CATALOG

Wide Range

KNIGHT Millers ADD SPEED TO EACH SHIFT'S PRODUCTION···

KNIGHT VERSATILE ACCURATE RIGID

Large work or small—milling or boring, roughing, or accurate finishing cuts—all are handled to equal advantage on this wide range machine. Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

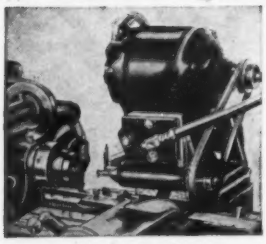
Greater speed is realized by users of KNIGHT Millers because of (1) the short time required to make set-ups, particularly difficult ones (2) the elimination of additional set-ups or at least the simplification of them (3) the quick and accurate location of holes and surfaces, especially when dial indicators are used (4) the quick change of vertical settings by moving the spindle instead of the work (5) the fast method of changing cutting tools (6) the swiveling table which greatly reduces the most expensive element in tool room operation—that of time waste in set-up work.

Subject to prior order immediate delivery.

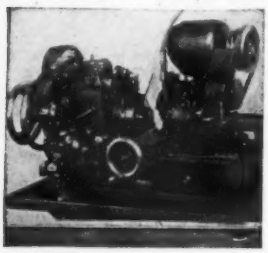
W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

WALTHAM THREAD MILLERS

put precision thread milling on a production basis



Waltham Thread Miller equipped with Internal Threading Attachment.

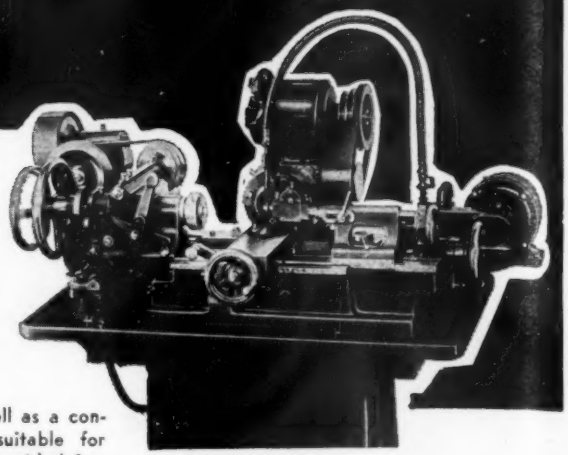


Machine equipped with Relieving Attachment.

These improved machines are fast, accurate and versatile. They will mill all standard forms of threads quickly, conveniently and accurately, cutters for which are available from Waltham.

Standard design includes three motors (one each for speed, feed and oil), a feature which permits individual speed change and reverse for both cutter and the work as well as a constant speed for the pump. Speeds suitable for either brass or steel or both are easily provided for. All motors are controlled from one convenient station.

Extra equipment available includes: plain and compound taper attachments, translating gears for cutting metric leads, metric lead screw, relieving attachment, special heads for internal and multiple cutter threading, and automatic cam operation, special equipment for cutting long lead.



SPECIFICATIONS

Swing over carriage 3"
Capacity (Diameter of work) 2" or smaller
Thread length (work held on centers) 8¾"
Thread length (work held in spring chuck at one end) 10"
Diam. hole through spring chuck ⅝"
Dia. hole through work spindle ¾"
Floor Space 48" x 34"
Motors: 1/3-1/4 and 1/6 HP

SEND FOR DESCRIPTIVE LITERATURE GIVING COMPLETE DETAILS.

WALTHAM MACHINE WORKS WALTHAM MASS.

WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF.

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!

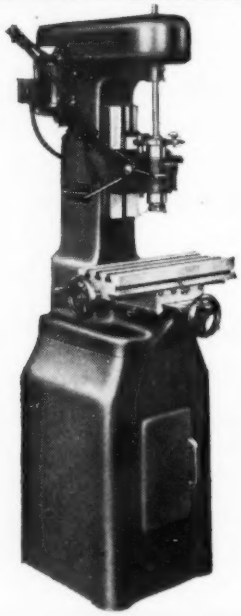
Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request—Write!

BURKE MACHINE TOOL CO.
CONNEAUT • • • OHIO

A VERSATILE HANDYMAN FOR BUSY TOOL ROOMS



LINLEY...
HIGH SPEED VERTICAL MILLING and JIG BORING MACHINE

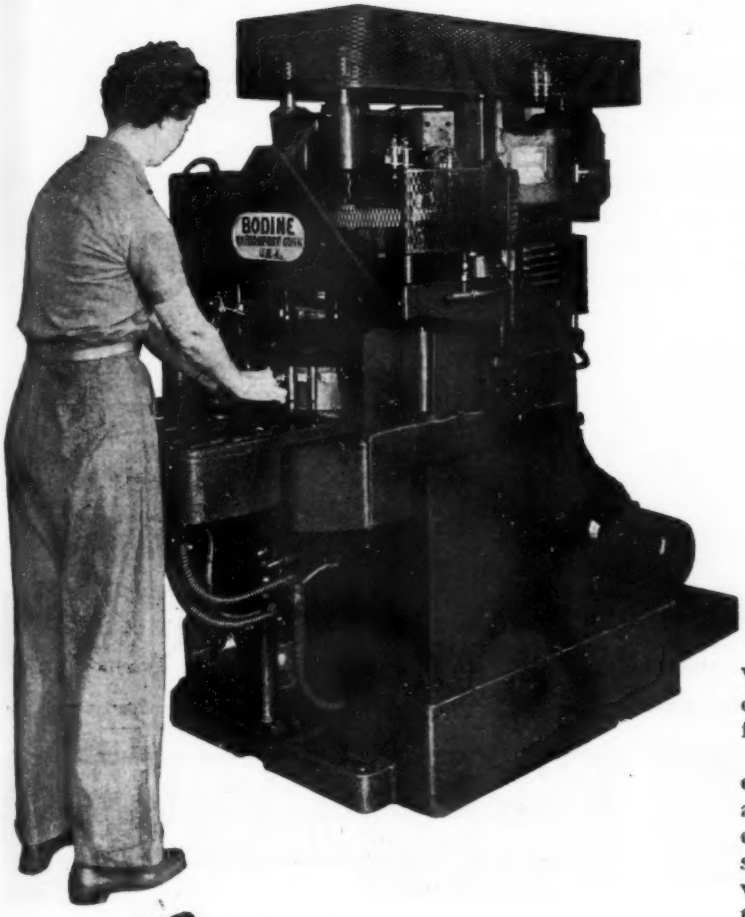
Truly the handy-man of the shop, this compact little machine takes . . . and efficiently performs . . . a greatly diversified number of jobs and frees your larger machines for heavier work.

The direct micrometer setting is so simple that work can be accurately machined to pre-determined depths without pencil figuring . . . without error. Eight spindle speeds, 275 to 4250 r.p.m., ample table size (7" x 17½") and small floor space (18½" x 20"). A carefully designed machine, well built and well able to earn its keep right from the start.

Write for complete information today.

LINLEY BROTHERS CO.
664 State Street Extension
BRIDGEPORT, CONN. U. S. A.

SHE dropped her *Broom* to run a *"Bodine"*



Women war workers who operate Bodine machines are fortunate. Theirs is a clean, easily performed job . . . with low fatigue factor.

Traditionally fearing things mechanical, they quickly discover that Bodines are simple. Fully automatic operation, electrical protective devices, easy feeding and ejection . . . all shorten the instruction period to a minimum. In a matter of weeks instead of months women reach and maintain the high schedules of which the machines are capable.

The combination of women's deft fingers and the mechanical efficiency of this high speed, multi-operation machine is rushing small parts to hungry assembly lines in enormous quantities.

The horizontal indexing dial automatically carries the work to progressive stations where machining to close tolerances is performed by vertical, horizontal or inverted spindles . . . in either consecutive or simultaneous operations.

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

BODINE does this:

1. Builds 6 standard models and develops the particular tooling for the work to be done.
2. Allows for the greatest flexibility in tooling set-ups for an extremely wide range of work.
3. Electrically protects machine, tools and work from damage . . . insures safety to operator.
4. Provides a compact design in all machines, which cuts floor space requirements to 54″ x 60″ for the smaller . . . 90″ x 96″ for the largest size.
5. Permits Milling, Drilling, Tapping, Screw Inserting, one or all operations, during one cycle of the dial . . . with manual or hopper feed . . . manual or automatic ejection, depending upon the nature of the part processed.

The Bodine Catalog gives engineering data and typical tooling set-ups for each size machine. It may be the means of simplifying and speeding up your particular operations. Copy gladly mailed on request.

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

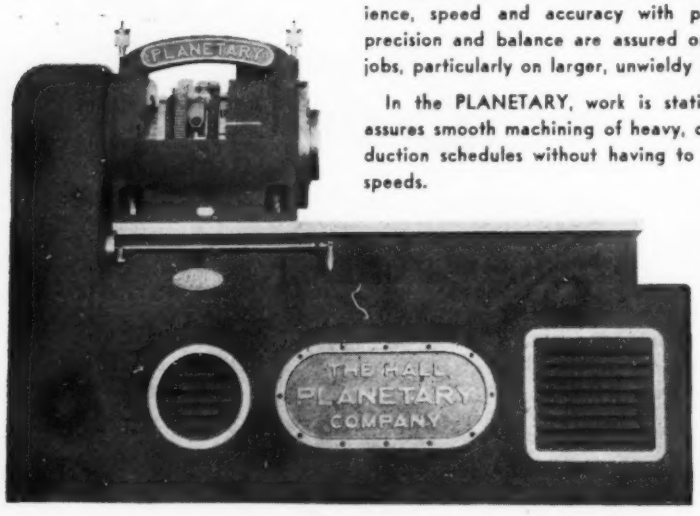
PLANETARY has the answer

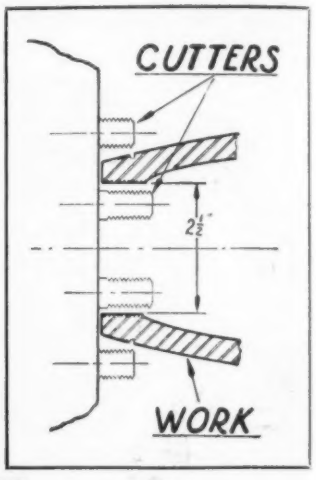
for SPEEDIER PRODUCTION

2 THREADS MILLED SIMULTANEOUSLY

Any variety or form of threads, including the most difficult, are easily milled on Hall PLANETARY Machines. Convenience, speed and accuracy with permanently dependable precision and balance are assured on all milling and facing jobs, particularly on larger, unwieldy pieces.

In the PLANETARY, work is stationary—a feature which assures smooth machining of heavy, difficult work at top production schedules without having to revolve the job at high speeds.





THIS JOB IN 90 SECONDS . . .

Shown here is drawing of a typical job—representative of thousands of different jobs being handled in record time on Hall Planetary Machines.

Send your blueprints for estimates.

THE HALL PLANETARY MILLER

THE HALL PLANETARY CO., Fox and Abbotsford Ave., PHILADELPHIA, PA.

MOREY *Designed and Built FOR Precision PLUS Production*

VERTICAL SHAPERS 8"–12"–14" STROKES

Four cutting Speeds . . . infinite feed variations quickly selected . . . Directional control for all movements . . . Rapid power movements in all directions . . . Brake for Ram automatically applied...OPERATOR CONTROLS MACHINE WITHOUT MOVING FROM HIS WORKING POSITION . . . Timken Bearings for Bull Gear, Shaft and Rotary Table . . .

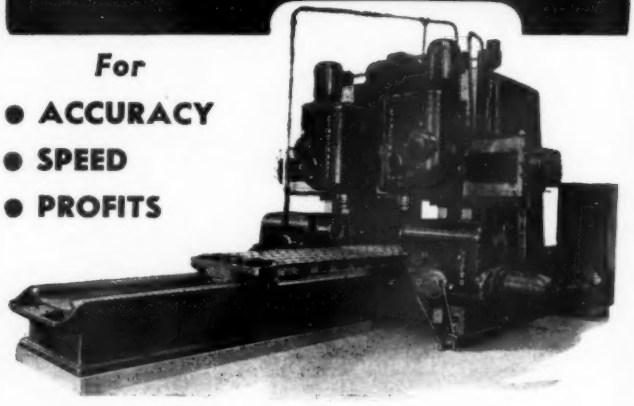
ACCURATE, POWERFUL, FAST, FINGERTIP CONTROL

Ask for Circular No. 726A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.

CINCINNATI HYPRO
Planer Type MILLING MACHINE!

For
- **ACCURACY**
- **SPEED**
- **PROFITS**



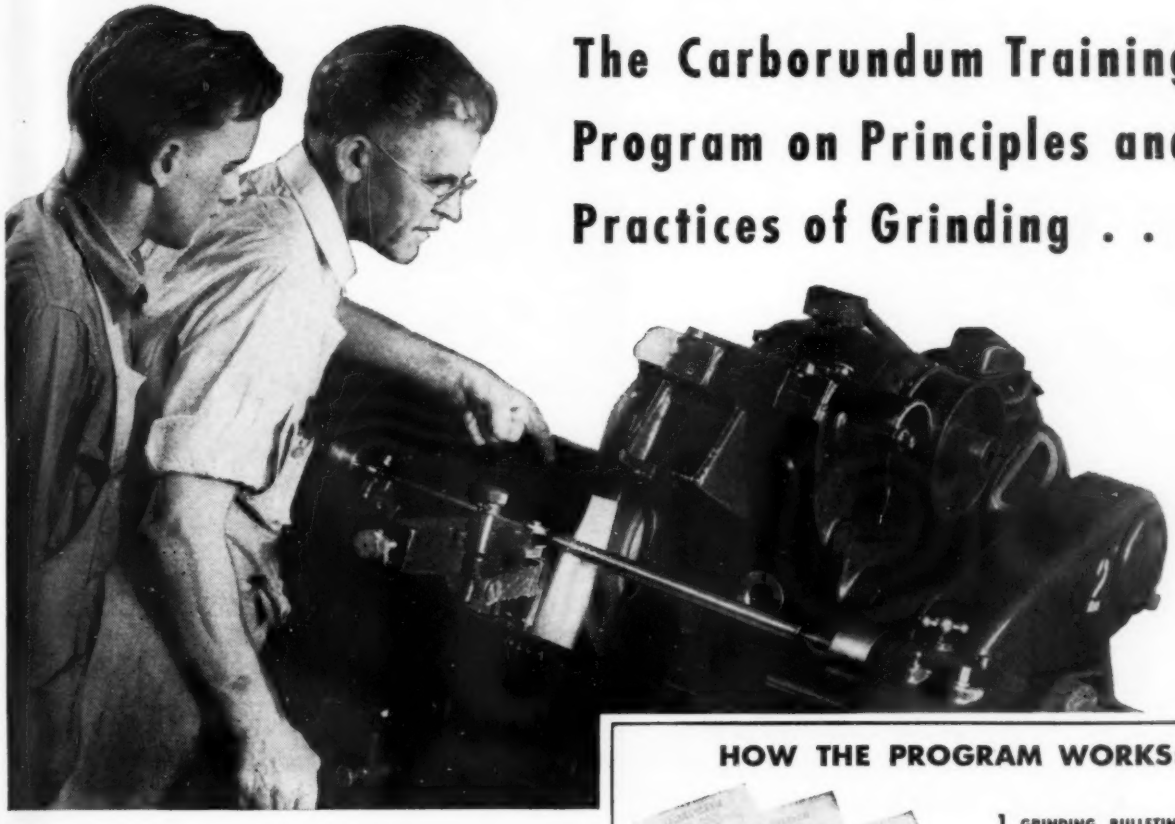
• Here's a machine designed for maximum rigidity to produce better work at a high rate of production. Combination Herringbone Gear drive to table provides smooth flow of power and freedom from side thrust pressures. Sizes up to 120".

Write for Bulletin 105.

Manufacturers of full line of Double Housing and Openside Planers and Vertical Boring Mills.

THE CINCINNATI PLANER CO.
CINCINNATI, OHIO

FREE! FOR TRAINEES IN INDUSTRY!



The Carborundum Training Program on Principles and Practices of Grinding . . .

THE problem of training green workers for precision war work is one of the biggest jobs industry has ever tackled.

Here is our contribution to its solution—a streamlined course in the principles and practices of grinding, offered to trainees in *your* Plant!

The purpose of the Carborundum Training Program is to explain in simple, non-technical terms the fundamentals of grinding and thereby help make better grinder hands of trainees, apprentices and students.

This course is designed for both classroom and small group instruction. Since its introduction, it has been widely adopted throughout industry. We hope it may help you, as it is helping others, to simplify the training of new grinder hands and to speed them on their way to higher production and greater accuracy.

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.

Niagara Falls, N.Y.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

HOW THE PROGRAM WORKS:

1. GRINDING BULLETINS. A set of 25 four-page bulletins for each trainee, offering a concise, non-technical discussion of grinding wheels and their functions. Sample of the contents: "The Abrasive Tools of Industry", "Wheel Stresses", "Wheel Balancing", "Cylindrical Grinding", "Grinding Errors", "Safety".

2. BOUND VOLUMES. A limited number of bound Grinding Bulletins are available for instruction as well as for placement in your classroom or technical library for reference purposes.

Educational Service Department
THE CARBORUNDUM COMPANY, NIAGARA FALLS, N.Y.

We would appreciate your sending us added information on the Carborundum Training Program.

☐ We have regular apprentice training courses. Average enrollment _____ students.
(Number)

☐ With _____ instructors assigned.
(Number)

☐ With adequate classroom facilities

Name.....

Title.....

Company.....

City and State.....

The Book of the YEAR!

VICTORY SCREW THREAD
DATA BOOK
With
Foreign and Domestic
THREAD SYSTEMS

CONTENTS

Definitions * Thread Series * Fits (Description) * Marking Symbols * Stockable Chaser Sizes * Coarse Thread Series—Basic Dimensions * Proposed National Extra Fine Thread Series * 27 Pitch Lighting Fixture and Brass Tubing Threads * Fine Thread Series—Basic Dimensions * Tolerances for Screws and Nuts Class 2 and 3 * 8, 12 and 16 Pitch Series * Class 2 Tolerances for Coarse and Fine Thread Series for Screws and Tapped Holes * Tap Drill Sizes for National Coarse and Fine Threads * American National Pipe Threads—Straight Pipe Threads * Acme Threads * Stub Acme * SAE Fuel, Oil and Tube Fitting Thread * Stub 60° Thread * Spark Plug Thread Sizes. British Standard Whitworth * British Standard Fine Thread * British Association Thread * Cycle Engineers Institute Thread * British Standard Pipe—Taper and Straight * International Metric Thread * French Standard Metric Thread * French Standard Thread * Lowenherz Thread—Decimal Inch Equivalent of Millimeters * Equivalent of Metric Pitches in Inches and Threads Per Inch * Three Wire System of Measuring Threads * Decimal Equivalents * Single and Double Depths of American National Whitworth and V Threads Compared * Cutting Speeds—Surface Feet * Weight of Bar Stock Per Foot * Guide for the Design and Purchase of Screw Machine Products * SAE Steels (Analysis) * Important Suggestions on the Design of Threaded Parts.

FREE to Factory Executives
who request it on a business letterhead;
others, 15 cents

H&G DIE HEAD

The Eastern Machine Screw Corp.
Manufacturers of H & G Die Heads
28-40 Barclay St. **New Haven, Conn.**

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WALTHAM MASS.
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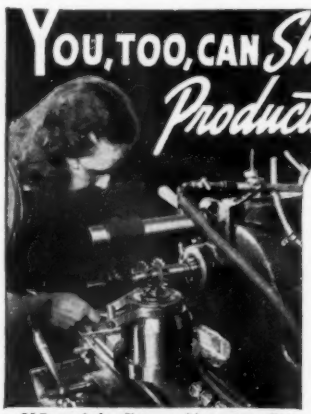


YOU, TOO, CAN *Short Cut Production Problems* with ZAGAR
INDEXING AND HOLDING
FIXTURES!

2" Zagar Index Fixture with master collet and pads, milling wrench squares with all-standard equipment.

CONTINUOUS PRODUCTION. Two 2" Zagar Holding Fixtures permit one part to be loaded while another is cut.

The applications shown here are only two out of very many which make difficult jobs easy and turn out two parts where only one grew before . . . Zagar Fixtures simplify milling, drilling, tapping, slotting and grinding operations. One handle opens, closes, indexes. Simple in design, rugged, quick, easy to use. Two sizes, 1" and 2", in both types. . . . Before you buy or build a special fixture for that next job, investigate Zagars.

Ask for our Bulletin A-5

COLLETS
In stock — Zagar No. 2 and No. 6 Collets, similar to W. & S. No. 2 and No. 6 Collets.

ZAGAR TOOL, INC.
23880 Lakeland Blvd. Cleveland, Ohio

Photos courtesy Kearney & Treaker Corp.

Husky CUTS REQUIRE *Husky* CUTTERS

SPECIFY LOVEJOY MILLING CUTTERS ON JOBS LIKE THIS

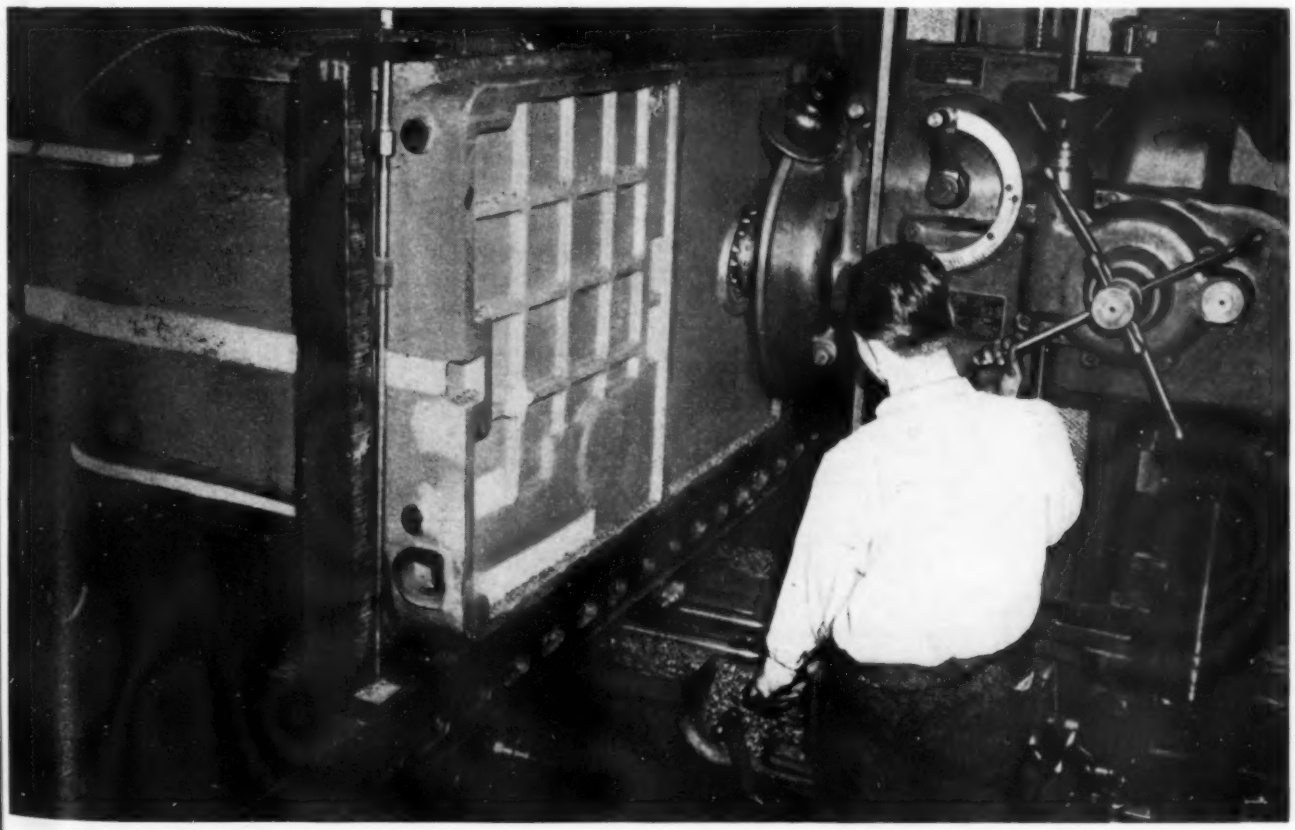
KEARNEY & TREAKER CORPORATION uses Lovejoy Type "A" Milling Cutters with positive-locking Lovejoy Blades on the milling job shown here. Lovejoy cutters are free cutting—they enhance the accuracy of milling and boring machines by reducing spindle strain and eliminating the "climbing" action of the cutter. Power consumption is thus reduced to a minimum.

Lovejoy cutters are economical to use. More than one-half of each blade can be used, yet short blades are held as rigidly as long ones. The positive-locking feature assures rigidity as well as reduces down time for the sharpening operation.

Try a Lovejoy on husky jobs like the big "Milwaukee" bed casting shown here — it will soon prove its accuracy, economy, and free-cutting qualities.

Complete details can be found in the Lovejoy catalog. Write for your copy today.

LOVEJOY TOOL COMPANY, Inc., Springfield, Vermont, U. S. A.



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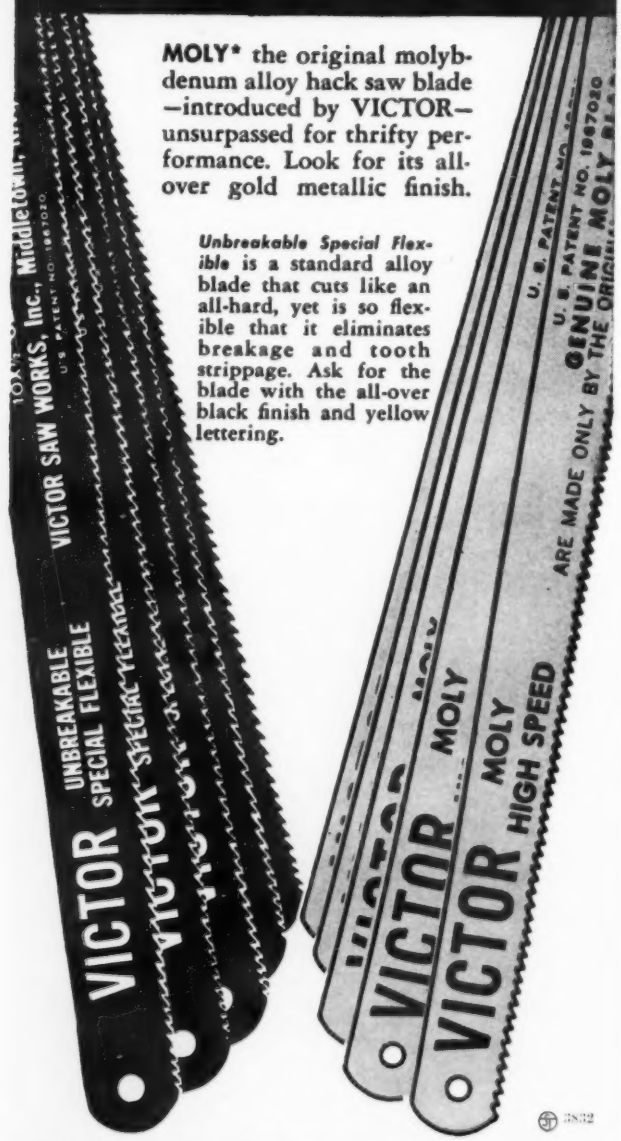

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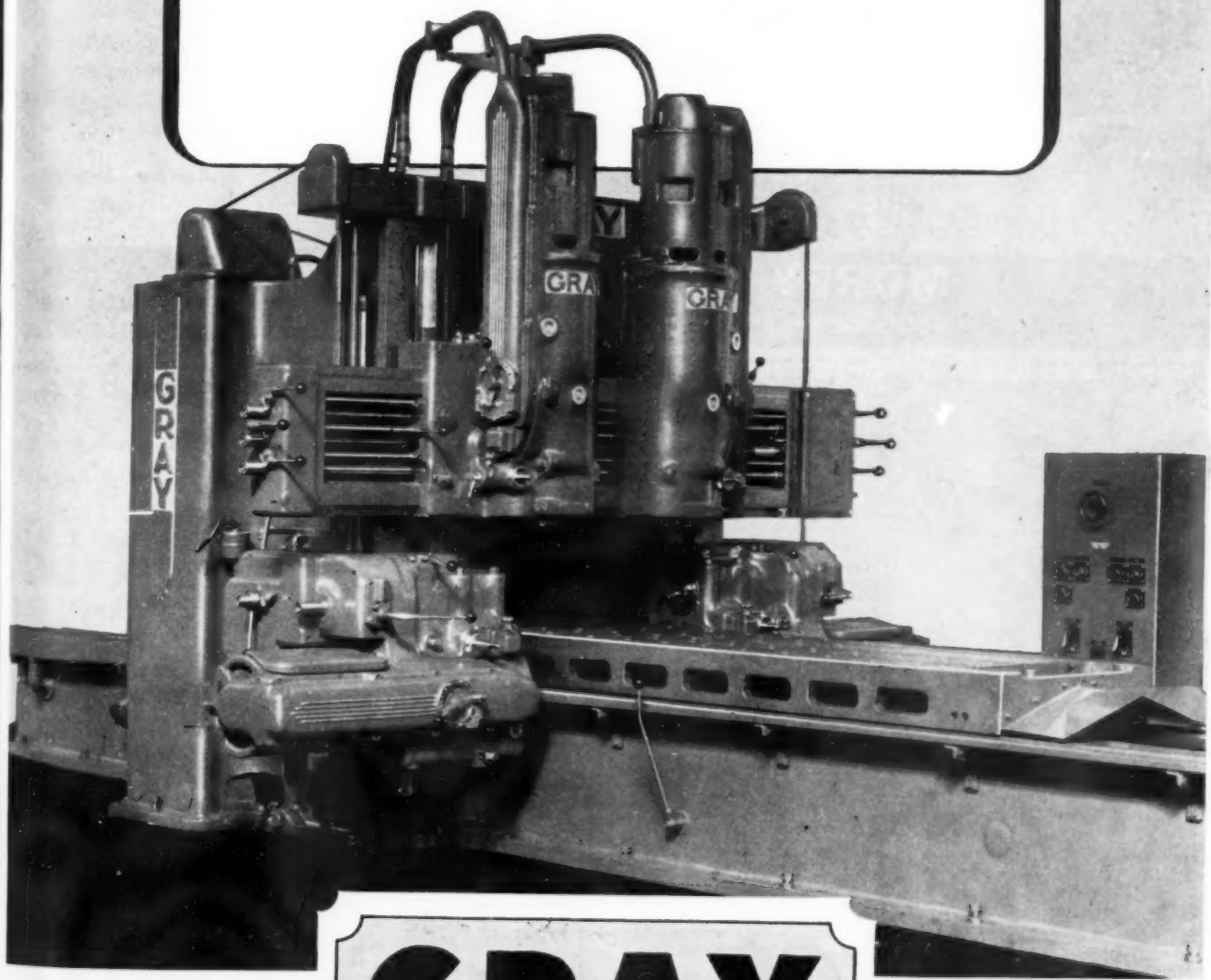

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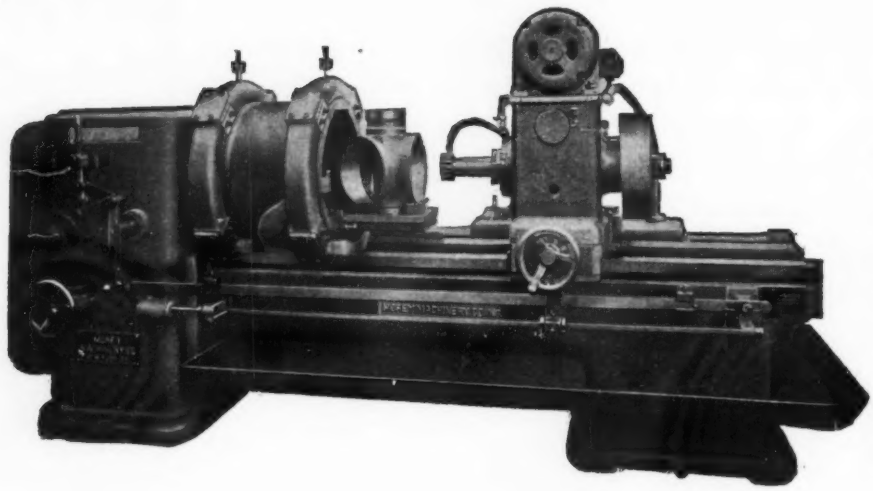

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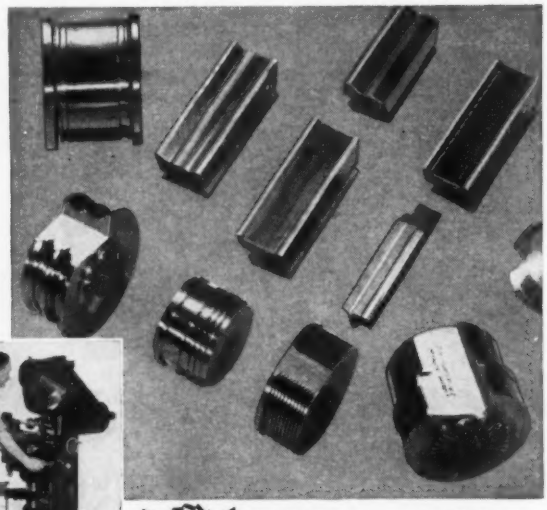

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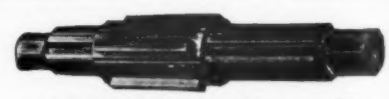

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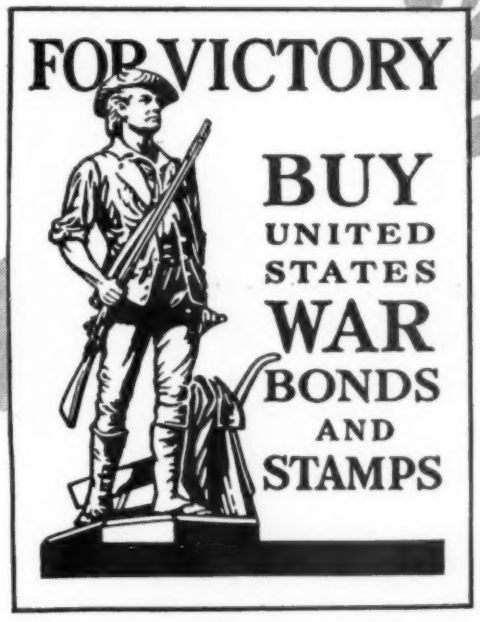

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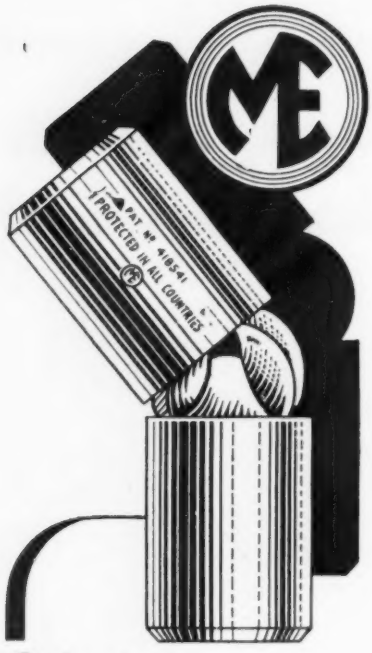

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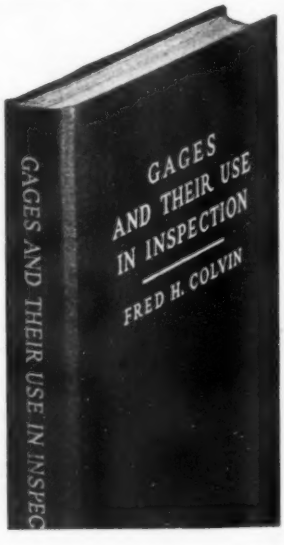

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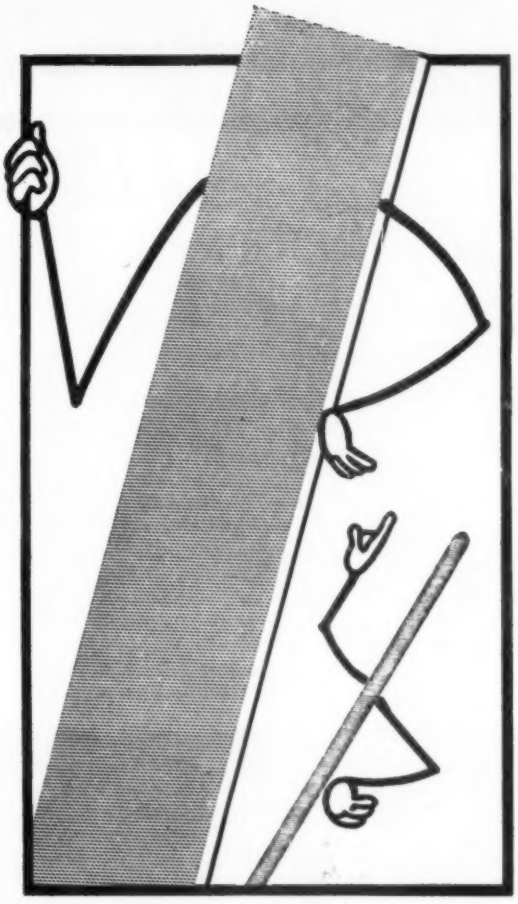

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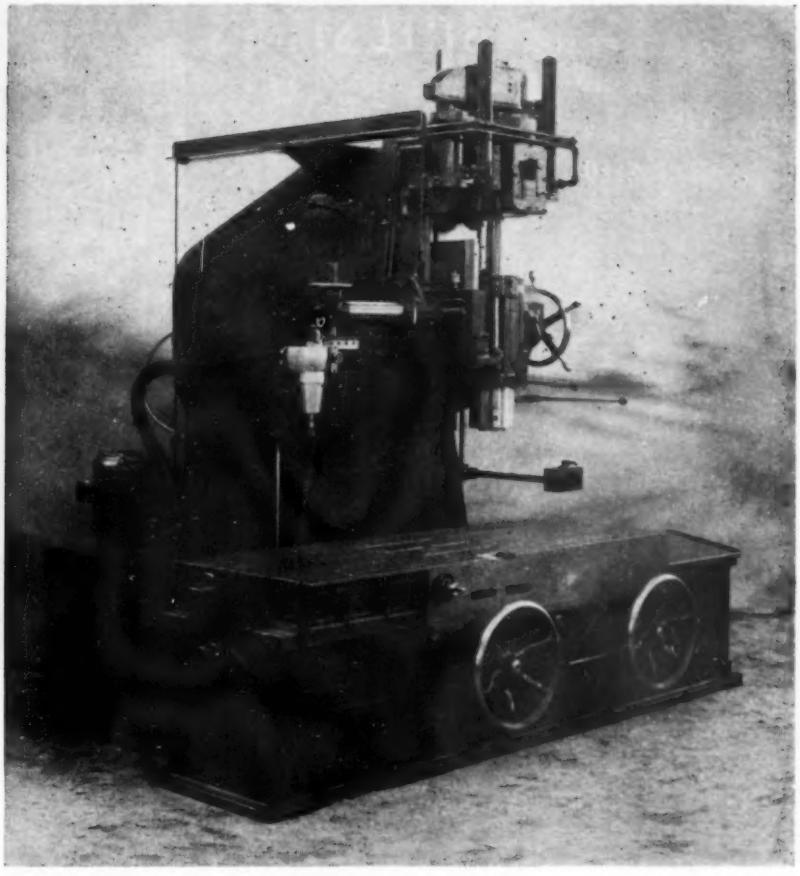

The machine shown here is equipped with a Turchan follower for duplicating dies from a mold or a master die. In addition to the 60" table length, a 24" extension, riding on the bed and bolted to table, is provided for carrying the pattern to be duplicated.

Specifications:

★ Table 30" wide x 60" long over working surface

A circular table 24" in diameter is built into each table at left hand end of main table.

Circular table has radial movement from front of table.

★ Distance top of table to under side of spindle—15" minimum, 33" maximum.

★ Depth of throat from center of table to face of column—23½"

★ In and out adjustment of ram that carries spindle head—30"—15" each side of center of table

★ Table Feeds—8- from ½" to 4" per minute

Ram Feeds—8- from ½" to 4" per minute

★ Spindle Speeds—18- from 33 R.P.M. to 1000 R.P.M.

15 H.P. motor to spindle drive

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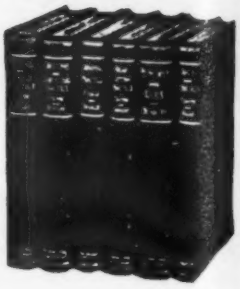

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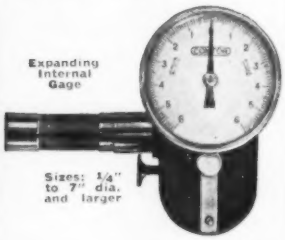

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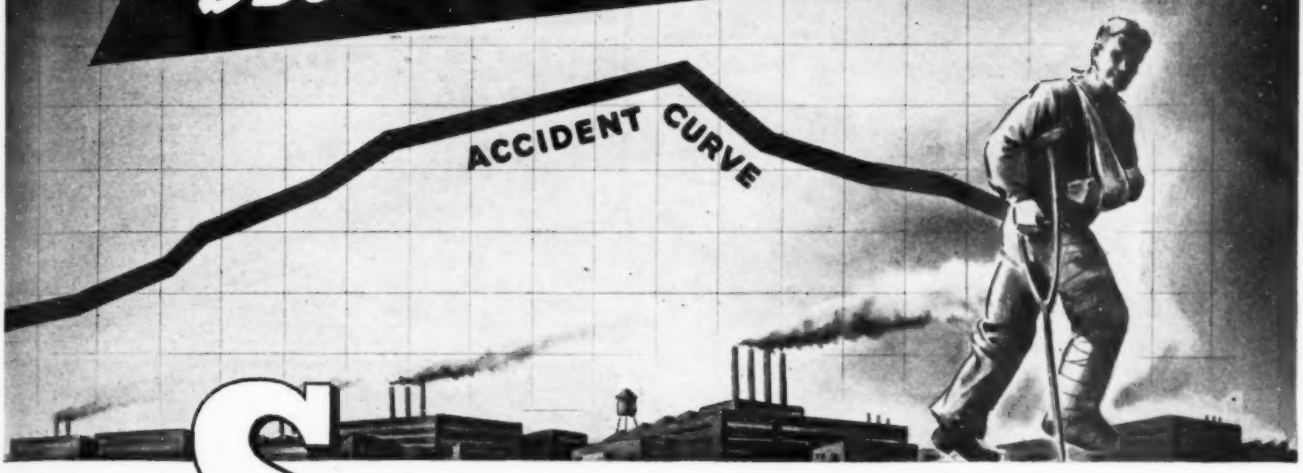

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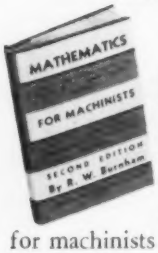

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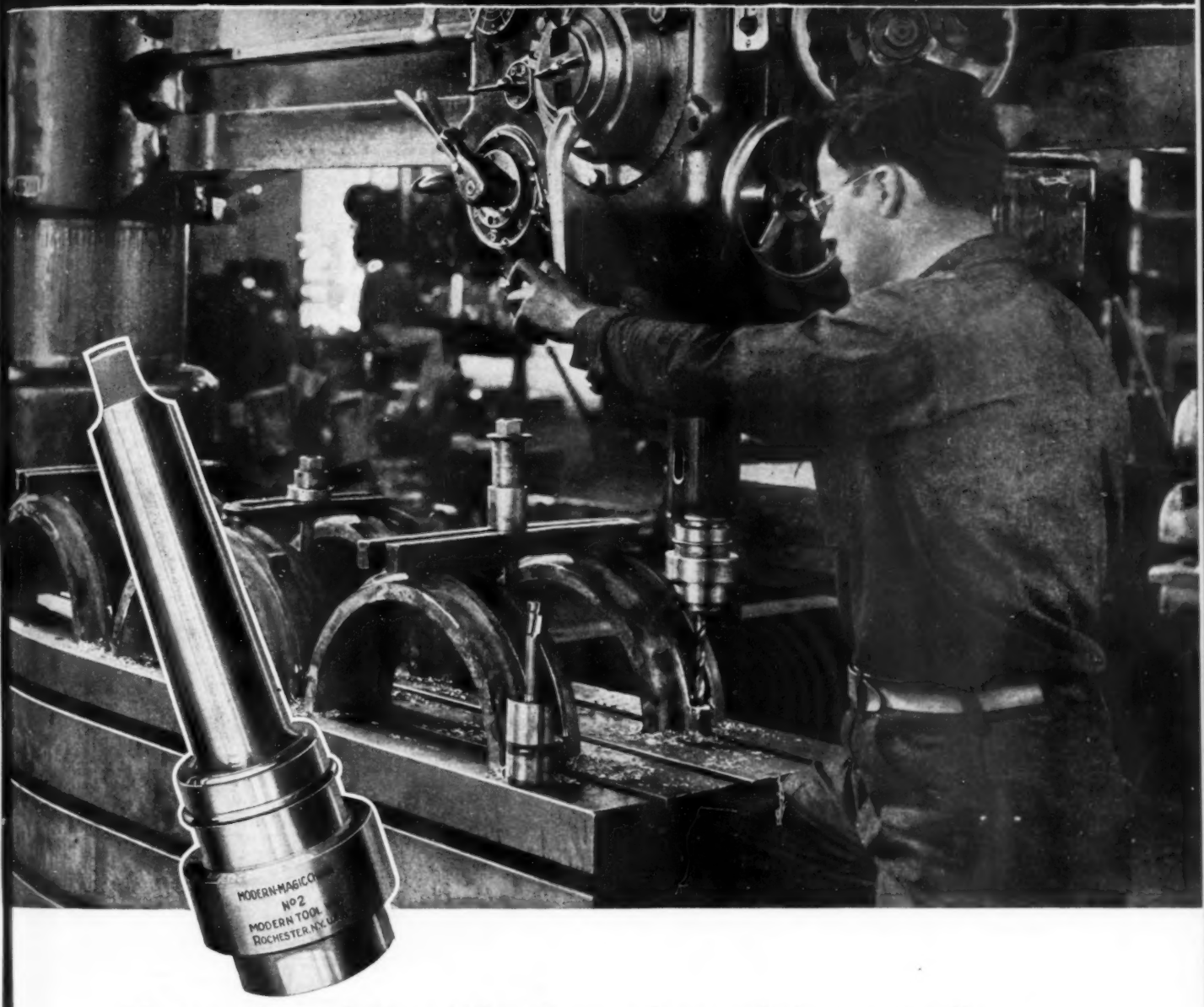

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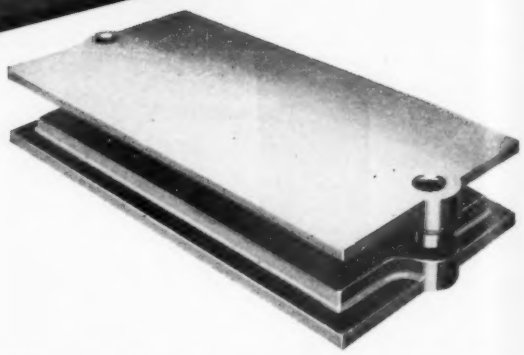

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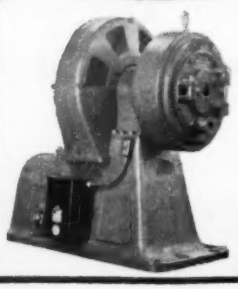

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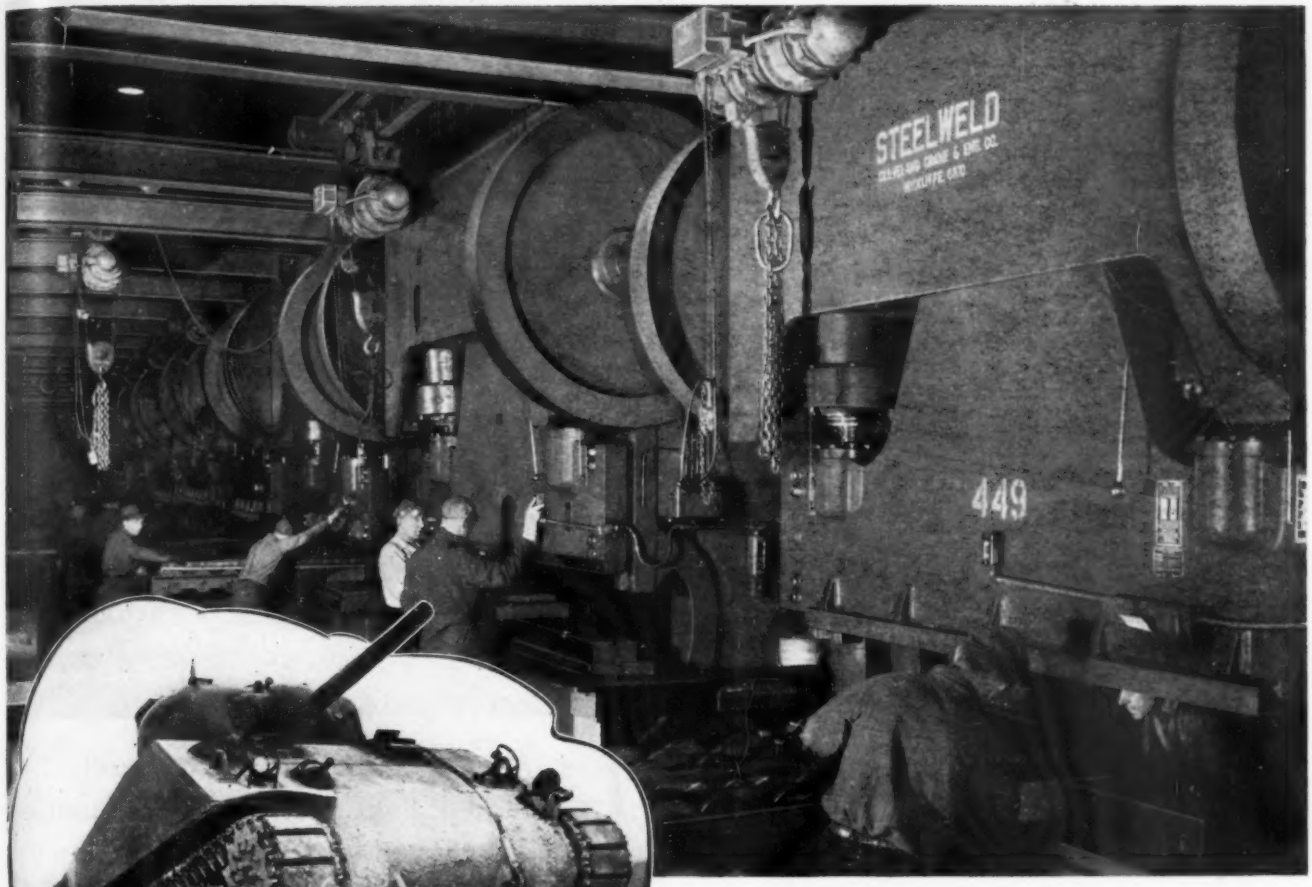

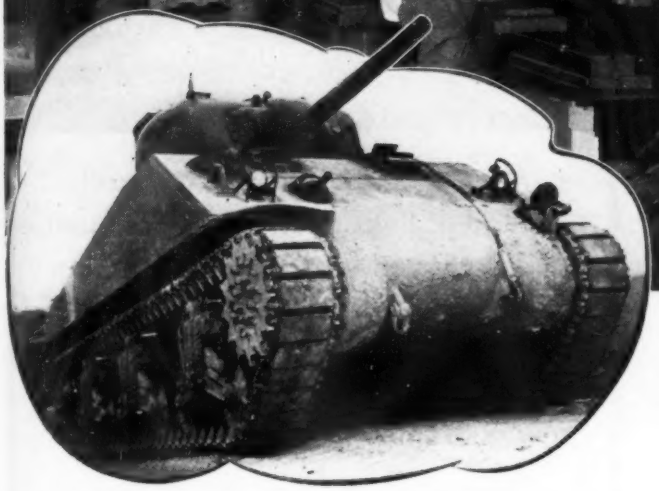

A few of a large battery of Cleveland Steelweld Presses in one plant straightening heavy tank armor plate.

Official O.W.I. Photo by Palmer.

M-4 tank with welded hull construction being tested at Aberdeen (Md.) Proving Grounds. Armor plate for this tank must be perfectly flat to assure accurate tight fits. Both cannon and machine gun are carried in revolving turret.

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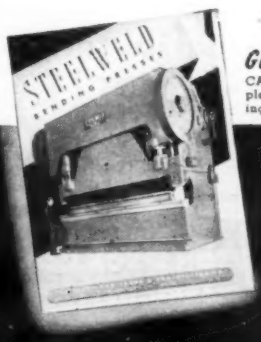

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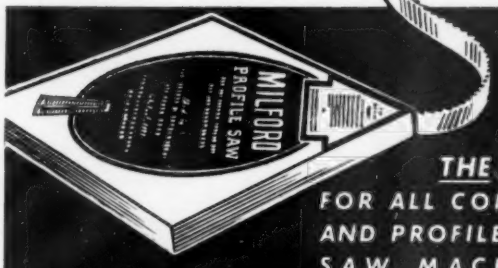

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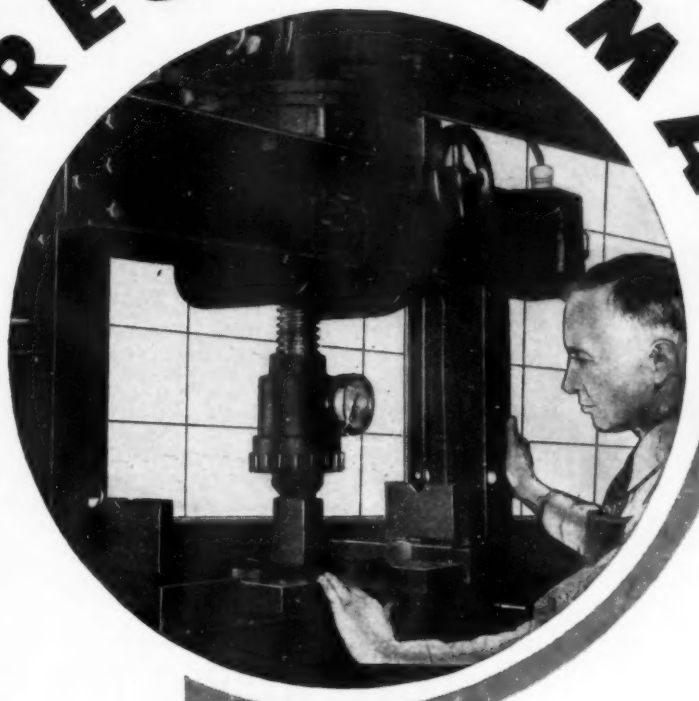

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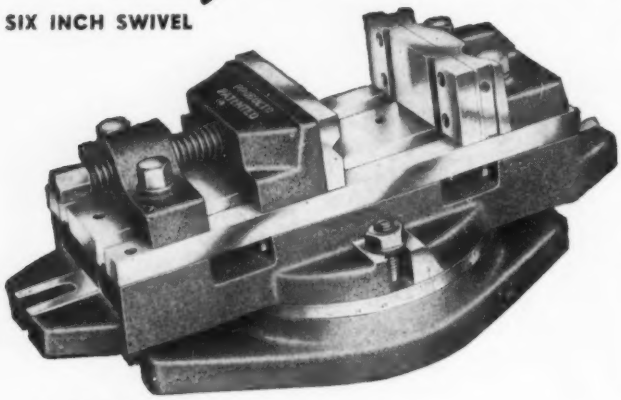

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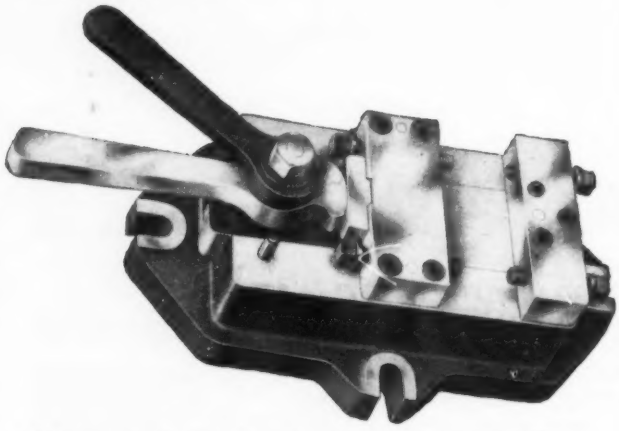

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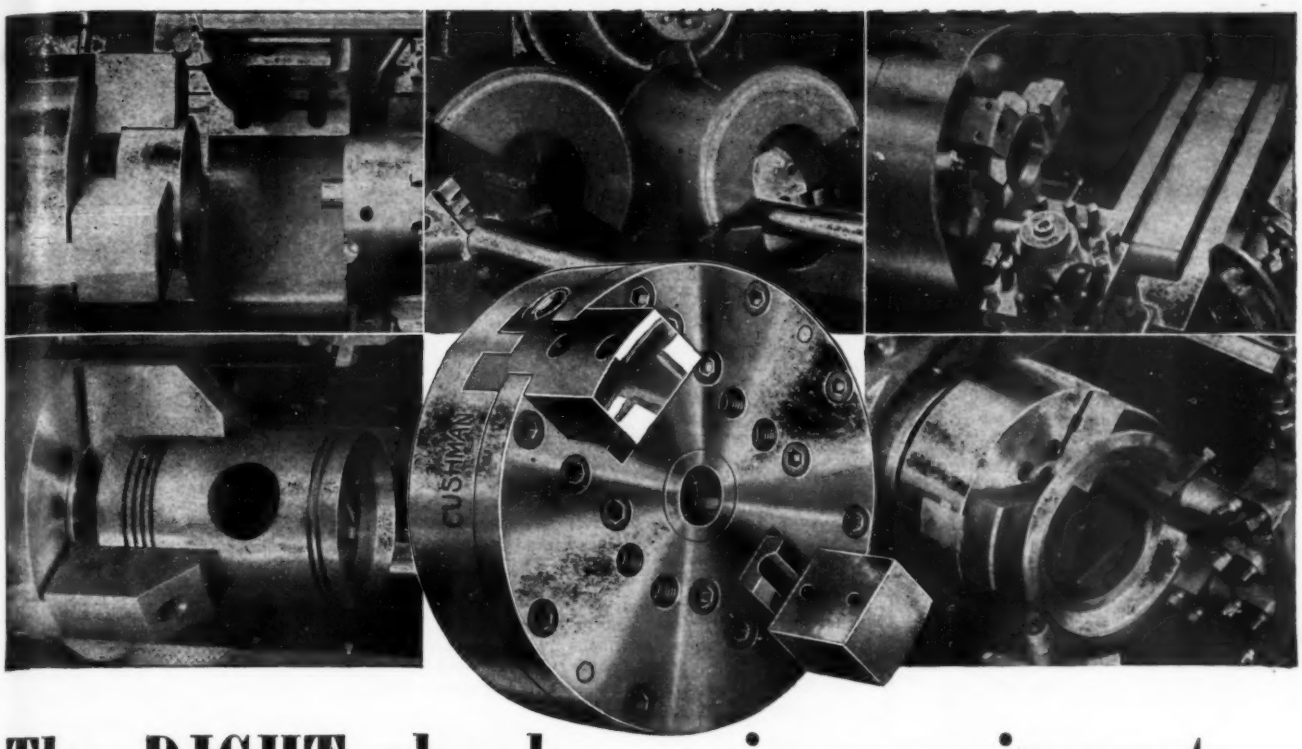

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SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

FOREMAN OR SUPERINTENDENT experienced Automatic Screw Machines, general machine shop practice, toolmaking power presses twenty-five years; ten as Executive. Native born, fifty years of age available June first. PW-586, American Machinist, 330 W. 42nd St., New York, N. Y.

SUPERINTENDENT or general production foreman 16 years general foreman specializing in all semi automatics—planning and layout, estimating, designing, tooling, retooling. Complete charge of 130 men—35 years practical experience—medium heavy machine work desired. Location New England or New York State. PW-587, American Machinist, 330 W. 42nd St., New York, N. Y.

AVAILABLE
ASSISTANT TO SUPERINTENDENT—GRADUATE MECHANICAL ENG'R

American citizen—40 years with 16 years of varied experience in machine shop work, drafting, tools, jig, fixtures, and machine design; development work, and engineering, wants position. About 5 years of this experience was in responsible charge. I am not afraid of hard work and responsibilities. Prefer Northern New Jersey, Metropolitan New York, or Connecticut.
PW-584, American Machinist, 330 W. 42 St., N.Y.C.

Executives, Engineers, Chemists and Metallurgists!

Qualified men wanted for openings throughout the United States. Write for application, or submit experience record.
Inquiries solicited from responsible employers.
All negotiations confidential. Est. 28 yrs.

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COMPETENT AMERICAN engineer with broad experience in product design and production engineering for low costs and high production. Age 57. Salary $8,000. Can organize, supervise, and train others. PW-561, American Machinist, 330 W. 42nd St., New York, N. Y.

AMERICAN ENGINEER, Master Mechanic with broad experience in products, machines and tool design for low cost and high production, age 57 can organize, supervise and train others. 40 years experience. PW-577, American Machinist, 330 W. 42nd St., New York, N. Y.

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PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

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"Toolife" Cutting Oil Agents wanted throughout U. S. for specialized sulphurized and non-sulphurized compounds—increased tool life over 20% proven—no dermatitis—must be acquainted with trade—state experience, details.

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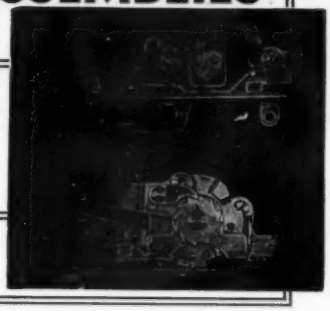

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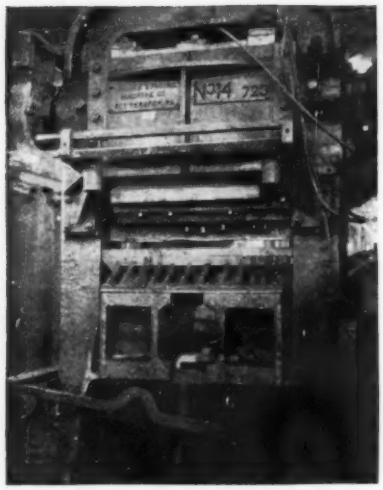

#14 — THOMAS SPACING MACHINE Complete with Tables—Now fitted as Plate Shear.
Capacity 42" wide 1¼ thick.
Prompt Delivery
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Pratt & Whitney #12 two-spindle motorized Profiler. Table 12" x 15" equipped with 6" raising blocks, and 5 H.P., 3 phase, 60 cycle, 220 V. motor—Turner drive mounted and wired to push button control—rebuilt and guaranteed.

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No. 4 LeBlond Heavy Duty Plain Miller with power rapid traverse, and vertical milling attachment, belt drive, double back geared, table working surface 16 x 62, Serial No. 1269.

P & W Duplex Miller #2.
Becker #7 Lincoln Production Miller.
Sanford #1½ Production Miller, Rotary Table.
Cleveland Vertical Miller #1 (New).

GEAR CUTTERS

No. 1 Adams Farwell Gear Hobber, complete.
No. 2 Whiton Spur Gear Cutter, Auto.
1—No. 3 Barber-Colman Gear Hobber.
Van Norman No. 0 Pinion Cutter.
Van Norman No. 1 Pinion Cutter.
No. 12 Barber-Colman Gear Hobber.

SHAPERS AND SLOTTERS

26" Concinnati Triple Geared Shaper, Friction Drive.
20" x 20" x 36" N-B-P Shaper-Planer, Arranged Motor Drive.
12" New Haven Slotter.

24" Bullard Vertical Turret Lathe Rapid Production, motor drive.
30" Colburn Vertical Turret Mill, M.D.
3½" Rochester Floor Type Horiz. Boring Mill, M.D.

RADIAL DRILLS

2—Niles-Bement-Pond, box column 5' arm.
1—Niles-Bement-Pond, box column 6' arm.

COILING MACHINES

No. 1 and No. 2 Sleeper & Hartley BX Cable Coiling Machines ⅜ and ½" cap. Last used for Speedometer cable. Complete.

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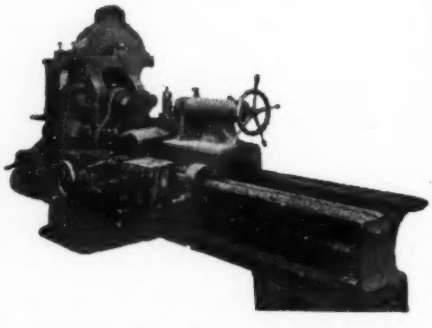
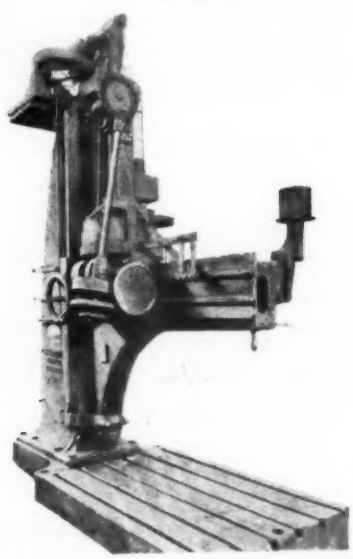
Wickes Combination Punch and Shear Motor Driven: 1¼" thru 1" plate; punching end 48" throat, shearing end 36" throat, continuous 6" x 1" plate.
Niagara No. 135 Deep Throat Punch Shear, Hydraulic Wheel Press 200 tons, 42" between strain bars, self-contained, belt drive.
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36" x 16 ga. Foot Shear.
Pittsburgh 36" x 3/16" Plate Shear, no holddown.
No. 132 Bliss 14 ga. 12" throat, Slitter.
No. 232 Bliss 12 ga. 18" throat, Slitter.
No. 94½ J Toledo Double Crank, Double Geared Twin Drive, Motor driven Straight Side, Tie Rod Power Press, Bed Area 120" x 50".
No. 18, 18C, 19 Bliss O.B.I.
No. 19 Truesdale O.B.I. Same as 19C.
No. 6 Waterbury Back Geared, Open Back.
No. 2 Bliss Back Flywheel Plain, (6).
No. 1 Bliss Back Flywheel Plain.
No. 15N Bliss, arranged Geared Motor drive, (2).
No. 25N Bliss Geared, motor drive, (3).
No. 1 Bliss Straight Side Toggle Press.
No. 103S Bliss Gang Die Press, roll feed.
3-ton General Flexible Press.
No. 30 Bliss Arch Press, Plain.
No. 25 Niagara Arch Press, Plain.
No. 71 Waterbury Coining Press, 25 tons.
No. 93D Toledo Double Crank Geared Straight Side Press, Welded Frame.
No. 2 Niagara O.B.I.
No. 3 American Can Co. O.B.I.
1—Niagara Combination Brake and Folder 6'10 gauge motor drive.

LATHES



Putnam 30" x 12' Heavy Duty Screw Cutting Engine Lathe, Quick Change Gear.
Putnam 26" x 12' Heavy Duty Screw Cutting Engine Lathe, Quick Change Gear.
30" x 18' Prentice Plain Change Lathe, with raising blocks to swing 42", belt drive.
20" x 16' Reed Light Type Plain Change Screw Cutting Engine Lathe.
18" x 12' Hamilton Plain Change Lathe.
19" x 8' LeBlond Heavy Duty Production Turning Lathe.
18 x 6 South Bend Plain Change Lathe.
16 x 8 American Quick Change Gear Lathe.
16 x 6 South Bend Plain Change Lathe.
14 x 6 Reed Lathe, Plain Change, motor drive.

RADIAL DRILLS



5' Niles-Bement-Pond Radial Drill

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Gridley 1¼" 4-spindle Model F Automatic.
Gridley 9/16 4-spindle Model G Automatic.
Brown & Sharpe No. 0 Cutoff.
Cone 1¼" 4-spindle Automatic Cutoff.

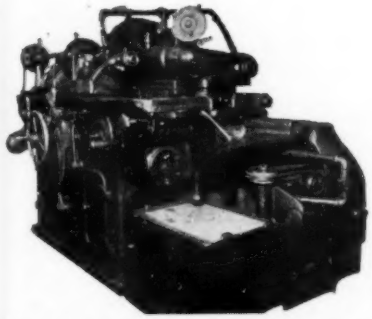
DRILLING MACHINES

1—15 H Fox Hydraulic 35 spindles, #1 M.T., motor drive.
1—D 31 Fox, drilled for 32 spindles, fitted with 16, #2 M.T. rectangular head 17 x 34, power feed, elevating table, motor drive.
1—No. 217 Baker, #5 M.T.
1—No. 3 Leland-Gifford 24", 2-spindle, with power feed, #2 M.T.
1—Cannedy-Otto Upright Drill.
1—Avey 4-spindle No. 3 M.T., with power feed to each spindle, motor drive.
4—20" Cannedy-Otto Upright Drills.
1—Edlund No. 2 Single Spindle High Speed Ball Bearing Drill.
1—Henry & Wright No. 2 single spindle, high speed, ball bearing Drill.
1—Allen No. 2, single spindle, high speed, ball bearing Drill.

INTERNAL GRINDER

Greenfield No. 12, Hydraulic Feed, motor drive; cap. swings 15", Grinds automatically ¾" to 5" dia., 4" deep, New in 1928.

Landis 10 x 36 Self-Contained Plain Cylindrical Grinder, perfect condtion, immediate delivery.



10x36 Landis Plain Grinder Self contained. Complete with Chuck. Back Rests and Centers.

TURRET LATHES

21" Gisholt Universal Turret Lathe with 3¾" hole in spindle, 2-step cone for 5" belt.
No. 2 Warner & Swasey Geared Friction Head, motorized; 1" bar cap., thoroughly rebuilt, immediate delivery.
Jones & Lamson 3 x 36 Double Spindle, air chuck equipment.
Jones & Lamson 2¼ x 26 Single Spindle, flat turret, single pulley drive.
2—3 x 36 Jones & Lamson Flat Turret, single spindle, single pulley drive.

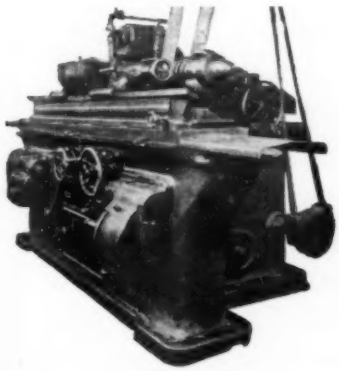
SHELL TRIMMERS

2—Waterbury-Farrell Automatic Trimmers ⅝ cap.

THREADING MACHINES

National 2" Double Head, Geared M. Dr.
Williams 6" Pipe Threading Machine.
Merrill 10" Pipe, Motor Drive with motor.
Curtis Portable Pipe Threading Machine—2".
Williams 2" Pipe Threading Machine.
Jarecki 2" Pipe Threading Machine.

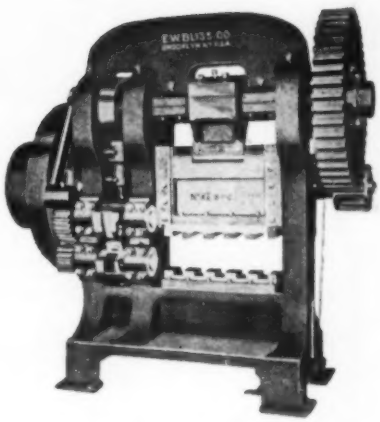
GRINDERS



1—#2 CINCINNATI UNIVERSAL CYLINDRICAL GRINDER

12"x36" belt drive complete—very fine mechanical and operating condition. immediate delivery.

14" Pratt & Whitney Vertical Surface Grinder.
No. 6 Besley Double Opposed Disc Grinder.
No. 2 and No. 3 Brown & Sharpe Cutter Grinder.
Taft-Pierce Automatic Pin Grinder.
Badger No. 2 Double End Disc Grinder 16" disc, ball bearing, spindle, Universal table.
Gardner No. 1 double end Disc, 12" Ball Bearing belt drive.
Gorton, double end Disc Grinder, 18" discs.
Sellers Tool Grinder.
#1 LeBlond Tool and Cutter Grinder.



"BLISS" THREE-COLUMN FORGING PRESS, No. 4 With Positive Clutch Code Word, Realishad

This press as shown, has machine steel upper and lower die holders, and a crank on end of main shaft operates two sector gears attached to rocking die holders for rolling tapers on claw hammers and other similar work. Axes—spring leafs, etc.

AUTOMATIC CHUCKING MACHINES

1—No. 24 New Britain type 4-spindle, 5 chucking station.
1—No. 23 New Britain type 4-spindle, 5 chucking stations.
1—Jones & Lamson Hartness Automatic Chucking Lathe Motor driven, 12" diameter, 6" face, 6" width cap.

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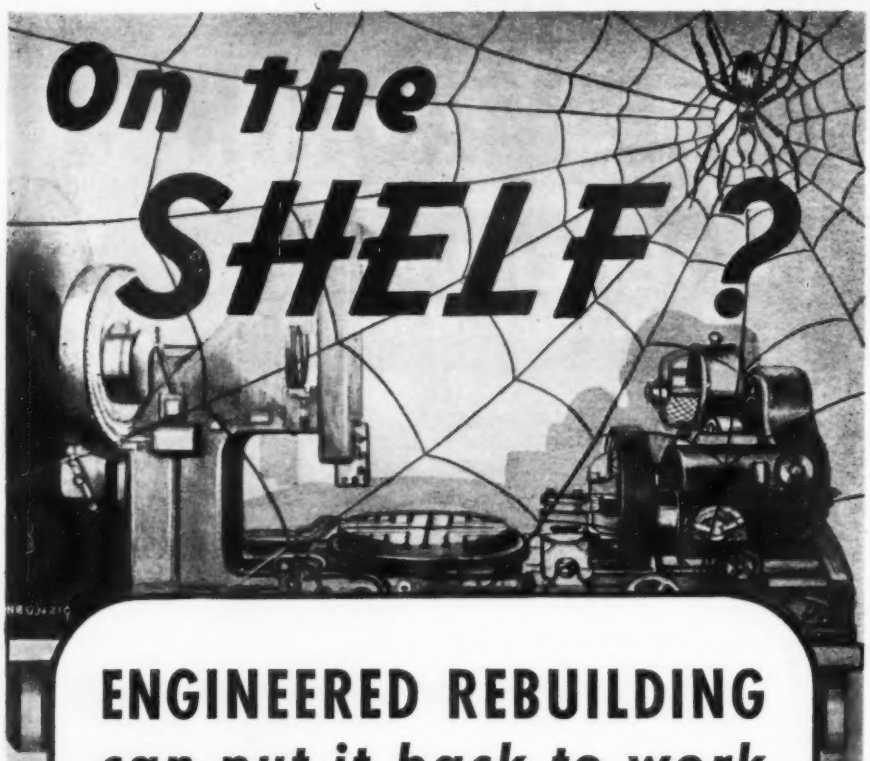

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For war today, for peace tomorrow, America requires the greatest arsenal of *workable* machine tools ever accumulated anywhere. Who can say we have enough? Who, indeed, knows what enough will be?

During the last several years the manufacture of metal-working equipment by American machine tool builders has surpassed all estimates and beliefs. But so have the requirements in this war of metal. And it may safely be predicted that the peacetime needs of a devastated world will also require *the full resources of our production.*

Therefore, not only must we continue producing to the limit of our capacity, but we must continue to make the most of what we have. Idle, disabled machine tools help only the enemy, especially when they can be reconditioned to function satisfactorily. Simmons can bring your machine tools "off the shelf" by its guarantee-backed method of *Engineered Rebuilding.* Investigate "The Simmons Way" today. You will help America's production program as well as your own.

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Every machine listed in this column is in our warehouse at press time.

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- 14" P&W Surface Grinder.
- 42" PUTNAM Double End Car Wheel Lathe, M.D.
- 6" x 6" x ⅝" Double Angle Shear.
- Beam Shear 20", 60# and smaller.
- 60" Throat 8" x 1 1/16 Shear.
- 54" Throat 1¾" x 1⅛" Punch.
- 6" BILGRIM Bevel Gear Generator.
- 15" GLEASON Bevel Gear Generator.
- No. 9 N.B.P. Vertical Miller 32" rotary table, 4" dia. spindle, M.D.
- 30" x 30" x 10" NEWTON Slab Miller, horizontal arbor, M.D.
- 24" x 24" x 10' WHITCOMB-BLAISDELL Second Belt Drive Planer.
- 48" x 48" x 24' NBP Heavy Planer. Two Rail, One Side Head, Motor Drive.
- 48" x 48" x 20' PATCH Planer, 4 heads, 230 Volt D.C. Rev. Motor Drive.
- 60" NEWTON Portable Slotter, 230 Volt D.C. Rev. Motor Drive.
- 24" NEWTON Cold Saw, 7½" capacity, M.D.

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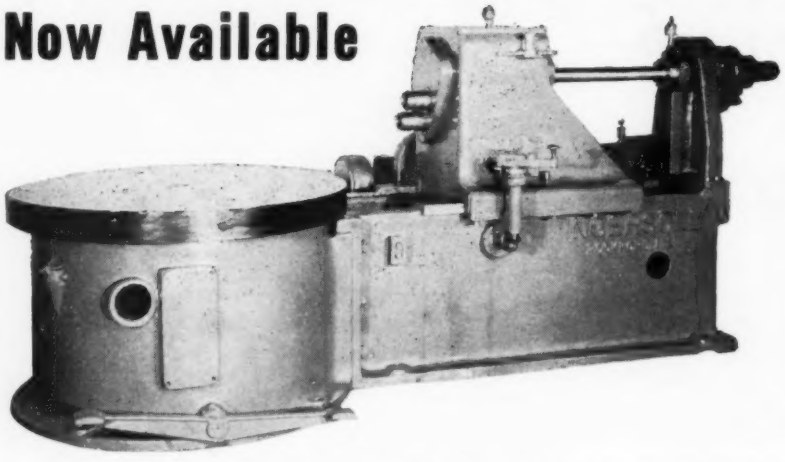

Head equipped with 2 spindles. Diameters of spindles, 3" and 2⅜". Centers of spindles to table, 7½" and 10¾". Horizontal travel of head, 16". Equipped with 48" rotary indexing table.

With 7½ H.P. motor and oilgear-pump.

These machines are well adapted for drilling and boring operations where it is necessary to use a fixture mounted on an indexing table. Located for immediate inspection at our Chicago warehouse.

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AUTOMATICS, Acme, #55 & 2"
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" SS.
AUTOMATICS, Cleveland, ⅞, 1¼, 2 & 2½" Model B.
AUTOMATICS, Cleveland, ⅞" 4 spdle cut-off, M.D.
AUTOMATICS, #22, 23 & 24 New Britain
AUTOMATICS, Potter & Johnston #5A & 6A
GEAR HOBBERS, 12 Barber-Colman
GRINDERS, Landis, 10x36, M.D.
GRINDERS, Norton, 14x36" Plain, M.D.
LATHE, Putnam, 60"x17' with 12" Riser Blocs, total swing 85" M.D.
LATHE, 3x36" J. & L. Dble. Spdle.
LATHE, Sundstrand, 8" Stub, M.D.
MILLING MACHINE, #8 Rocker Duplex, M.D.
MILLING MACHINES, Becker Vertical, Model C & S.D.
MILLER & DRILLER, Knight #2
PLANERS, 36x36"x10' Hamilton 2 Heads, M.D.
PLANERS, 42x42"x12' Ohio, 1 Head, M.D.
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo, #2 & 3 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back
PROFILERS, 2 spdle. Garvin & #2 Pratt & Whitney

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18" Niles-Bement-Pond, Motor driven, Power rapid traverse.

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30x30x12' Gray Spur Grd. Planer, m.d.
12x18" Cinci. Plunge Cut Grinder, m.d. with 9" face wheel, and oscil. att.
3' Carlton Sensi. Radial, with tapping att.
6' Niles Plain Radial Drill.
5', 13" col. Cinci-Bick. Plain Radial
#5A P.&J. Chucking Machine, with hardened ways
#45 G.&L. Hydraulic Surface Grinder with mag. chuck
#4 G.&L. Hydraulic Surface Grinder with mag. chuck

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Bolt Cutter 1" capacity 3 spindle
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Compressor 6" x 5" Pennsylvania
Drill, new 10" Buffalo bench
Drill, ceiling suspended, unlimited drilling area
Drill Press, 20" three spindle Barnes
Drill, six-spindle Henry & Wright, 12" overhang
Grinder #20 Bryant deep hole internal
Grinder 60" plate
Grinder #60 Heald, cylinder
Grinder, Sellers Tool
Lathe 14"x12' Ledge-Shipley grd. hd. s.c. mtr. dr.
Lathe, 24" x 18' Steptoe-MacFarlan
Motors—new ½ to 30 HP 3 phase ball bearing
Pipe Machine, 6" Oster (new)
Press #8-7 Zah-Hahnemann straight side grd.
Punch & Shear ⅞" capacity Rock River
Punch & Shear, two ½" capacity
Threading Machine #0 Webster & Perks
Turret Lathe L & D brass, cross slide turret
Vacuum Cleaner, heavy duty for shop use

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COLUMBUS, OHIO

36' x 24" PUTNAM Heavy Duty Triple Geared, Internal Geared Faceplate Drive Engine Lathe. Arranged for motor drive. Swings over ways—38".
LANDIS 8" to 18" inclusive Pipe Threading Machine. Gear box, single pulley drive.

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24" Bullard "New Era" Boring Mill.
1000# & 2000# Steam Forging Hammers.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24"-32" Shapers.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY
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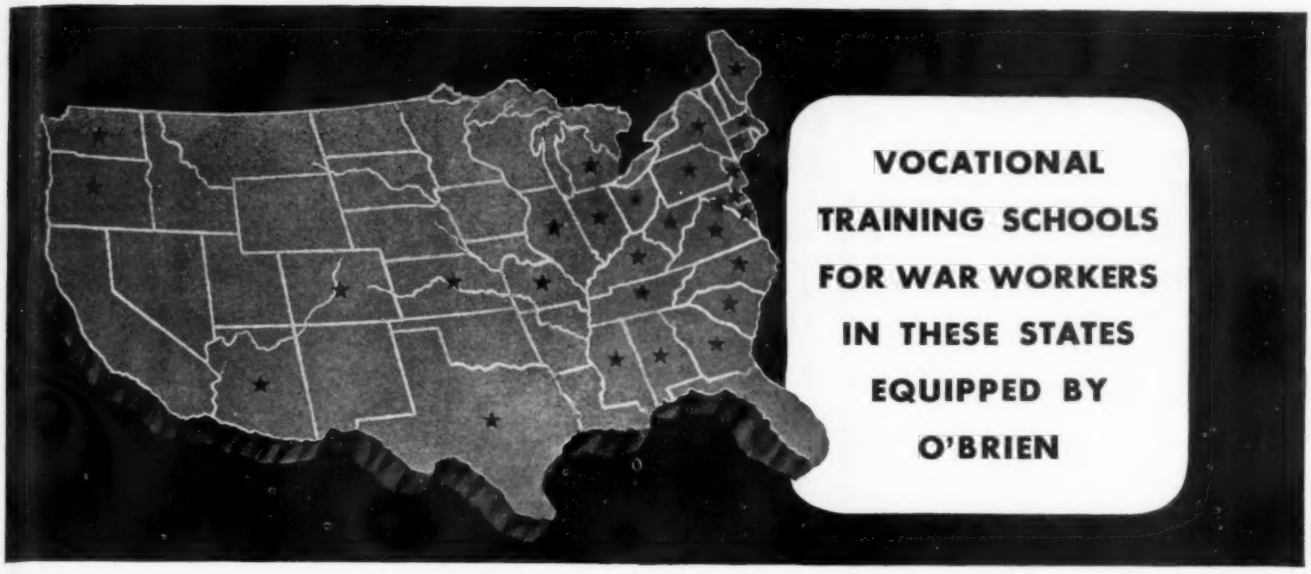

IT'S a good possibility that new man who runs your boring mill was trained on an O'Brien rebuilt machine. Here's why:

In addition to a vast quantity of rebuilt machine tools and power plant equipment supplied for war contract work, O'Brien also figured decisively in the war training program. Approximately 225 schools in over half the states in the Union have turned out countless workers on O'Brien rebuilt machine tools. Many of those schools could not have started had it not been for rebuilt machinery. As responsibility for training is absorbed by industry itself, these same tools will follow into active war work.

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4½" N.B.P. duplex control, horizontal, table type m. d., geared feeds and speeds, table 33"x60", will bore to center of 72", distance face plate to outboard support 84".

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2½" Landis triple head, motorized, with dies.

COMPRESSORS—528 CFM Chicago Pneumatic NSB b. d., 100# pressure.
254 CFM Chicago Pneumatic NSB belt drive, 125# pressure.
173 CFM Ingersoll Rand ER belt drive, 100# pressure.

DRILLS—5' Bickford Radial, 13" column, motor drive.
4 spindle Leland Gifford B.B.Sensitive, #2 taper, tapping attac.
16" Henry & Wright, belt drive, Sensitive, B.B. #2 M.T.

GRINDERS—#6 Bryant Internal Grinder, 12" swing, b. d.
18" Gorton Disc Grinder, belt drive, two universal tables
6"x18" Landis, plain, self-contained, motor drive.

LATHES—30"x18' Houston-Stanwood & Gamble, mtrzd. q. c.
24"x10' Flather engine lathe, belt drive, plain change
20"x10' Bradford engine lathe, belt drive, plain change
19"x8' Sidney engine lathe, belt drive DBG, quick change
16"x6' South Bend engine lathe, belt drive, plain change

MILLERS—Hendey "Lincoln" type Production Miller, table 9"x30", belt drive
Cincinnati Knee type Mfg. Millers, 18" travel, table 12"x34"

PLANERS—48"x48"x16' Patch reversing motor drive, one side and one rail head.

SHAPERS—16" Gould & Eberhardt belt drive, with visa.

SHEARS—10' George Ohl 16-gauge Squaring Shear, m. dr.
18 gauge ½" Capacity Ryerson rotary bevel shear.
8' Niagara foot Shear.

NIBBLER—#1B Campbell 24" throat, cap. 3/16", motor dr.

TURRET—2A Warner & Swasey geared head, 2½" bar cap., with collet chuck & collets.

WHEEL PRESS—200-ton Caldwell 38" between the bars, motor drive with pump.

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Other Plants urgently need unused machine tools! If you are nearing the end of a war contract and can release machine tools, write or telephone us at once!

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D2 Ferracute S.A. Drawing
P2 Ferracute Stiles Type
No. 6 Waterbury-Farrel D.C.
851 Ferracute D.C., 50 tons cap.
30 ton Lourie Hydraulic
Metalwood Hydro-Pneumatic B33
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No. 496D Toledo D.C. Toggle Drawing
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No. 2B, 5, 6 Cochran-Bly Cold Saws
No. 3, 8 Nutter & Barnes Cold Saws
No. 11½ Higley Cold
No. 15 Lea-Simplex Cold
Knowlton Cold, 24" blade

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No. 2B Foster Universal Geared Head, m.d.
No. 2 Warner & Swasey Universal Hollow Hexagon
18" Libby Type A, 3⅛" hole
26" Libby Type C, 7½" hole
20"x7' American Turret
2 spindle 3½x36" Jones & Lamson, chucking
3x36" Jones & Lamson, bar

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Landis Chaser Grinder, s.p.d.
Gleason Cutter Grinder
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800 lb. Bement Steam
1100 lb. Bement-Miles Steam
2000 lb. Niles-Bement-Pond Steam
25000 lb. Bement-Mills Steam

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1" Morton, belt
No. 2 Baker, belt
No. 2 Morton, belt
No. 4 Mitts & Merrill, belt
Morton Keyway Cutter & Slotter, 24" stroke

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36"x16' Springfield
36"x10' Putnam
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24-48"x14' McCabe 2 in 1
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20"x16' American Geared Head Spindle Boring Lathe
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14"x6' Champion
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Niles-Bement-Pond Quartering Machine, new
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BULLARD 24" R.P. Vertical Turret Lathe—With side head

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GLEASON 10" Spiral Bevel Gear Gen.

GLEASON 6"-18" Bevel Gear Gen.

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100 Assorted Milling Machine Attachments
DIVIDING HEADS
Vertical-Slotting—Rack Cutting
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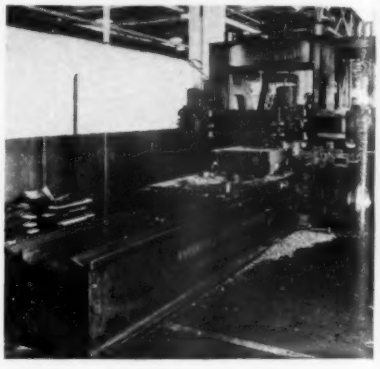

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GRINDERS—30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 14" x 96" Cinci. M.D.; 12" x 96" Landis; 12" x 120" Landis; #6 Landis Internal; 14" Pratt & Whitney Vert. Surface, Type B, M.D.; 24" Bridgeport Disc D.C., M.D.
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PLANERS—48" x 48" x 16' Cinci., 4 hds., M.D.; 36" x 36" x 12' Putnam, 3 hds., M.D.; 36" x 36" x 10' Cinci., M.D.; 27" x 6' Woodward Powell, M.D.; 22" x 22" x 5' Whitcomb.
LATHES—16" x 6' Simplex, Q.C.G.; 18" x 6' Greaves Klusman Grd. Hd.; 32" x 12' Pittsburgh, Q.C.G. blocks to 44"; 36" x 16' Bridgeford Grd. Hd., T.A.; 2¼ x 26" Cinci. Acme Turrets (2).
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Gridley four-spindle Model H Chucking Machines, M. D.
72" x 36" x 10' table Ingersoll Mill

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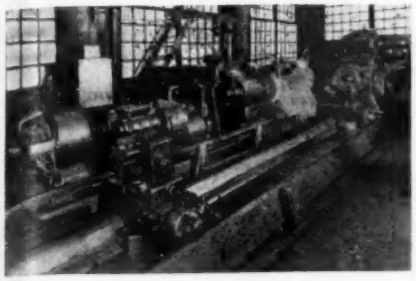

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10' Niles Vert.
3½" Rochester, M.D.
4", 4½" Gisholt and Niles
54" Colburn, M.D.
36" Bullard, Niles
36" Bullard Vtl.

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Modern 12x48", M.D.
B. & S. No. 10, 11, 14
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Cincinnati No. 5 Plain, M.D.
B. & S. No. 33, M.D.
B. & S. No. 1½ Univ.
Hendey-Norton No. 2 Univ.

AUTOMATICS

3—Potter & Johnston No. 6A Turret Lathes, M.D.

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48"x26' Niles
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26"x12' Boye & Emmes
26"x14' Rahn-Larmon rais. blks to 34"
24"x14' Rahn-Larmon
36"x21' Wickes Lathe, 3 step
30"x20' LeBlond std. change
24"x12' LeBlond, M.D.

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#55 National Acme, 1⅜" Cap. M.D.

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Flather, 30", Swivel Turret Head
4" Bickford Horizontal, Single Pulley

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Norton, Cylindrical, 6x32"
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Leblond, 14x6' M.D.

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#2 Cincinnati Universal
#3 Garvin-Duplex 12x64"
#7 Becker Production
#5B Brown & Sharpe M.D.
#3 Universal Pedrick & Ayers
#11 Pratt & Whitney Vert. & Profiling
18" Cincinnati Production
Trundle Auto. Double Sp. Thread
#12 B. & S. Mfg. Miller

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Bickett (Cincinnati, Ohio) 42x42x12' Heavy M.D.
Gray, 36x36x12. 2 Heads on rail

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6' Niles Universal Radial Drill, 13" round column
Foote Burt Drill Press, heavy duty
Gould & Eberhart Drill Press, 24" Sliding Head, Compound Table
28" Snyder Drill Press
20" Upright Drills
Leland Gifford 4 Sp. All Power Feed
Allen 3 Sp. Hi Speed Drill
Sipp 4 Sp. Hi Speed Drill

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10" G & E, 14" Whipp & 18" Robur.

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Garvin 12½ SG 2"
Garvin 2½ SG 1 7/16"
Jones & Lamson 3x36" 2 Sp.
Jones & Lamson 2x24" M.D.
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2½" Cleveland Model A, single spindle
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96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS
No. 2 Cincinnati Centerless
22"x48" Pratt & Whitney Vertical Spindie Surface, Timken Bearing
30" Diamond Face, 84" Table Travel
Walker Rotary Surface
6"x32" Norton
14"x50" Norton Cylindrical
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No. 1 Cincinnati Tool & Cutter
No. 60 Heald Cylinder

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9" Sundstrand Manufacturing, g.h.
18"x8' Lodge & Shipley, c.d.
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TURRFT LATHES
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2A Warner & Swasey, g.h.
18" Steinle, g.h.
24" Steinle, g.h.
No. 6A Potter & Johnson, g.h.

MILLS
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No. 4 Cincinnati, c.d.
No. 2 Cincinnati, s.p.d.
No. 12 Brown & Sharpe, c.d.
4" Pratt & Whitney Spline
4½"x12" Pratt & Whitney Thread Mill

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26″ x 10′ Niles, Cone, Q.C.

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#55 Heald Cylinder.
Lees Bradner Gear Grinder.

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18″ Gleason Bevel Gear Generators.
6″ Bilgram Bevel Gear Generator.
18H Gould & Eberhardt Gear Hobber.
#1 Adams Gear Hobber.
#4—36″ B & S Automatic Gear Cutter.
Lees Bradner Gear Grinder.
#3—26″ B & S Gear Cutter.

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24″ x 24″ x 6′ Cincinnati Planer.
24″ x 24″ x 6′ Cincinnati Planer, Box bed M.D.
72″ x 60″ x 28′ Pond 2 heads, Belt drive.

MISCELLANEOUS

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14″ Niles Slotter.
1500# Bell Steam Hammer.

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7″ Baird 6 spindle
6x6¾ Goss & DeLeeuw
4½″ Gridley model H
1⅝″ National Acme No. 55
14″ Fay
No. 6A Potter & Johnston
1″ Cleveland Model J
No. 16 Gisholt Simplimatic

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No. 16 H8 Gould & Eberhardt hobber
No. 12 Barber Colman hobber
No. 1 Lees Bradner hobber
26″x8″ Brown & Sharpe automatic
24″x12″ Flather automatic
36″x6″ Gould & Eberhardt automatic
48″ Brown & Sharpe automatic
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18″ Gleason testers & lappers
15″ Gleason spiral gear roughers
15″ Gleason spiral pinion roughers
18″ Gleason bevel gear generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

LATHES

28″ Steinle, 8″ hole
24″ Gisholt, 6½″ hole
24″ Steinle, 6¼″ hole
32″ Libby, 4½″ hole
24x24 & 3″x36″ Jones and Lamson
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13″x6′ Automatic threading
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8″ Sundstrand stub
9″ Sundstrand Mfg.
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30″ Ransome elec. snagging
16″ Norton snagging
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18″ Whitney wet tool
36″ No. 5TGM Bridgeport wet
Cincinnati face milling cutter grinder
Pratt & Whitney grinder for worms

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Taft Pierce thread miller
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3⅞″ Beaman & Smith horizontal boring mill
36″ Garvin cam & form miller

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24″x24″x5′ Gray
24″x24″x6′ Woodward & Powell
29″x29″x6′3″ New Haven
36″x36″x10′ Betts 2 heads
36″ Morton draw cut shaper

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LATHES

14″x6′ Mulliner—cone

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24HS Gould & Eberhard Gear Hobber, M.D.
9″ Pratt & Whitney Gear Grinder, M.D.
14″ Gleason Bevel gear generator
Cimatool gear chamfering M.D.
Lees-Bradner Gear Grinder

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6x6½″ Goss & DeLeeuw

MISCELLANEOUS

8″ Bullard Multimatic M.D.
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Lees-Bradner Spline Hobber 6″x54″

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New Delta Drilling Equip.
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NEITHER TOO LITTLE NOR TOO LATE

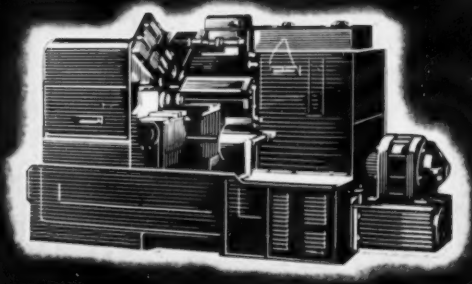
ARMY E NAVY

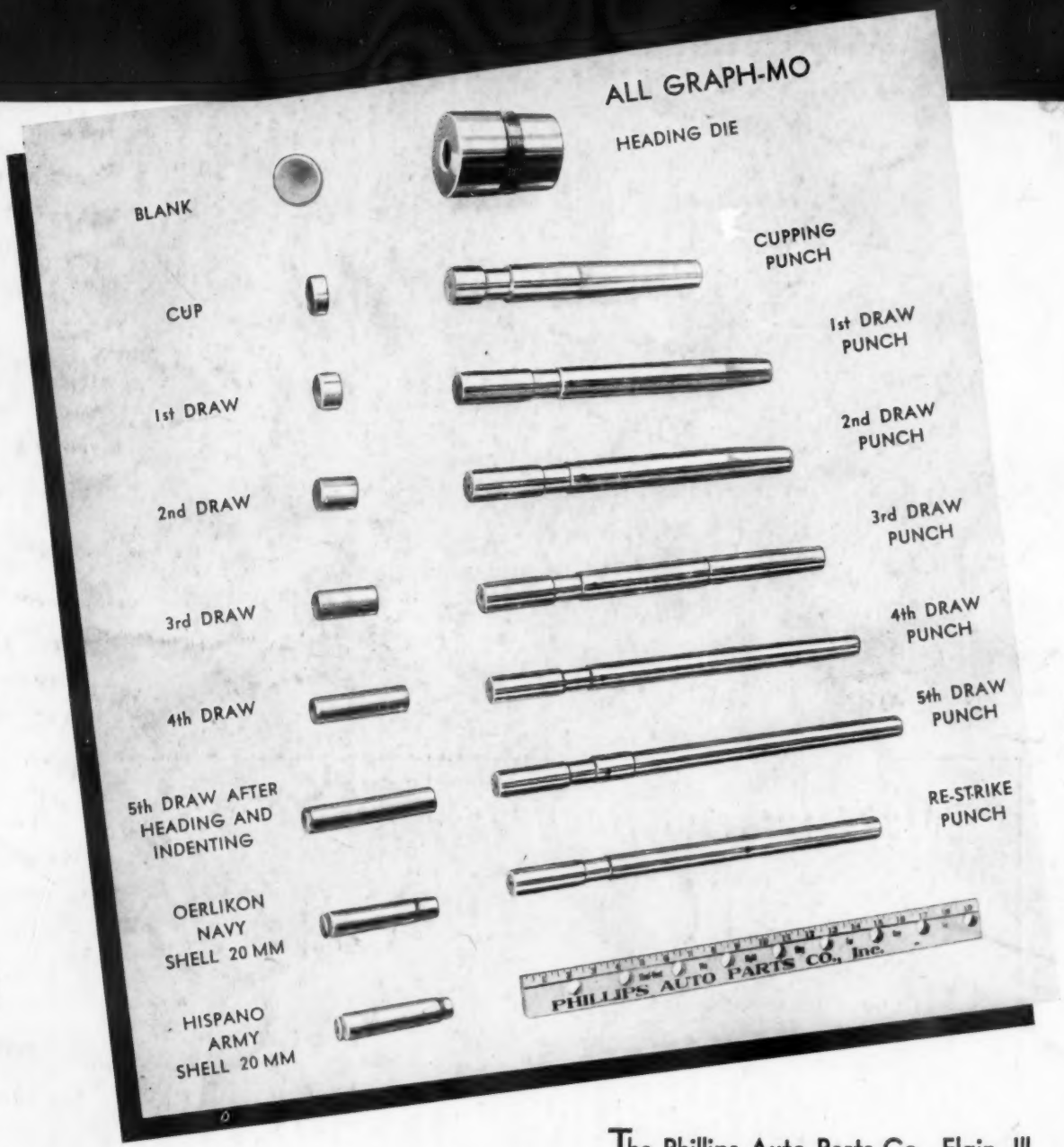
● One reason that has made American leadership in arms possible in so short a time is her genius in engineering and production. In this, New Britain Automatics are an integral part.

NEW BRITAIN AUTOMATICS

NEW BRITAIN-GRIDLEY • MACHINE DIVISION

THE NEW BRITAIN MACHINE CO. • NEW BRITAIN, CONN.





The Phillips Auto Parts Co., Elgin, Ill., uses Timken Graph-Mo Steel in the manufacture of cartridge punches. Says Mr. Phillips: "This steel machines more easily than other steels we have used and is less subject to distortion. Our men like to work with it."

Many other producers of munitions and munition dies and tools are using Graph-Mo Steel for these same reasons.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division